

Effects of Precocenes on Ovarian Development of the Seed Bug, *Oxycarenus lavaterae* (F.) *

M. I. Baldellou and X. Bellés **

Departamento de Química Orgánica Biológica (C.I.D., C.S.I.C.)
08034 Barcelona (Spain)

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Antigonadotropic activities of Precocene 1 (P1), Precocene 2 (P2) and Ethoxyprecocene 2 (EP2) on the seed bug *Oxycarenus lavaterae* (F.) (*Heteroptera, Lygaeidae*), are reported. EP2 proved to be the most active compound followed by P2 and P1, which agrees with the structure-activity relationships reported for these compounds thus far. Mortality in both sexes was further studied. In this context, compound P2 showed the highest degree of toxicity. Males, interestingly, appeared to be more sensitive to the toxic effects of Precocenes.

Key words: Precocenes, Juvenile hormone, Antigonadotropic activity, *Oxycarenus*.

Induction of precocious metamorphosis and impairing of fertility are the most conspicuous consequences of chemical allatectomy caused by Precocenes. According to results so far reported, sensitivity to morphogenetic effects seems to be quite restricted to a few Hemimetabola insects, whereas antigonadotropic activity has been demonstrated in a broader variety of species (3, 4). Nevertheless, since factors determining species susceptibility to Precocenes are not still well es-

tablished, further research for broadening the number of sensitive insects could be a complementary approach in order to clarify the mechanism of action of these compounds.

In the case of the seed bug *Oxycarenus lavaterae* (F.) (*Heteroptera, Lygaeidae*) we have previously reported the morphogenetic effects induced by Precocenes when applied on third instar larvae (2) and the influence of these compounds on sexual behaviour (1). We report herein further progress in the assessment of the effects of Precocenes by describing their antigonadotropic activity on this species.

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** To whom all correspondence should be addressed.

Materials and Methods

Assays were carried out with freshly ecdysed adult specimens of *O. lavaterae*

(less of 24 h of adult age) collected from a laboratory culture reared at 25 (± 2)°C, 60-70 % R.H. and 18 h of photophase, and fed with linden seeds (2).

Synthetic Precocenes, 7-methoxy-2,2-dimethyl-2H-chromene (Precocene 1: P1); 6,7-dimethoxy-2,2-dimethyl-2H-chromene (Precocene 2: P2) and 7-ethoxy-6-methoxy-2,2-dimethyl-2H-chromene (Ethoxy-precocene 2: EP2), were prepared in our Institute and applied by contact method. Bottom parts of glass petri dishes of 4.5 cm diameter were internally coated with an acetone solution of Precocene, providing—after evaporation of the solvent—a continuous layer of active material. Groups of 5 females and 6 males were confined in these treated dishes where food and drinking water were also ensured. Control groups were reared under the same conditions on untreated dishes and on dishes treated with pure acetone.

The ovarian development was checked 7 days after the treatment, by measuring and averaging 3 basal oocytes of each

ovary per specimen, after dissection under Ringer's solution.

Results and Discussion

Two main types of responses were studied as a consequence of Precocene treatment: mortality in both sexes and inhibition of ovarian development.

Concerning mortality, the compound P2 showed the higher degree of toxicity. Moreover, males appeared to be more sensitive to the toxic effects of Precocenes (table I). These results differ somewhat from those obtained when third instar larvae were treated topically in assays conducted to elicit morphogenetic effects, in which compound EP2 exhibited the greatest toxicity (2).

Results on oocyte growth are also depicted in table I. Large standard errors found in some experiments are intrinsic because some specimens showed a drastic inhibition and some resulted unaffected,

Table I. Toxicity of precocenes on both sexes and effects on ovarian development of *Oxycarenus lavaterae*.

PV: previtellogenic oocytes (0.10-0.37 mm); VO: vitellogenic oocytes (0.38-1.00 mm); DO: fully developed oocytes (> 1.00 mm).

Treatment	Females						Males	
	N	Mortality (%)	Oocyte length (mm \pm SD)	Oocyte length categories (%)			N	Mortality (%)
				PV	VO	DO		
25 $\mu\text{g}/\text{cm}^2$ P1	20	60	0.10 \pm 0.01	100	0	0	24	88
10 $\mu\text{g}/\text{cm}^2$ P1	30	53	0.16 \pm 0.07	100	0	0	36	42
5 $\mu\text{g}/\text{cm}^2$ P1	40	3	0.49 \pm 0.38	56	21	23	48	13
1 $\mu\text{g}/\text{cm}^2$ P1	30	13	0.95 \pm 0.36	20	4	76	36	3
10 $\mu\text{g}/\text{cm}^2$ P2	30	40	0.10 \pm 0.01	100	0	0	36	69
5 $\mu\text{g}/\text{cm}^2$ P2	30	30	0.16 \pm 0.05	100	0	0	36	44
1 $\mu\text{g}/\text{cm}^2$ P2	40	8	0.83 \pm 0.40	28	8	64	48	4
5 $\mu\text{g}/\text{cm}^2$ EP2	30	3	0.15 \pm 0.04	100	0	0	36	22
1 $\mu\text{g}/\text{cm}^2$ EP2	40	8	0.28 \pm 0.21	89	8	3	48	10
0.1 $\mu\text{g}/\text{cm}^2$ EP2	30	3	0.96 \pm 0.31	10	17	73	36	0
Acetone	30	3	1.00 \pm 0.29	14	0	86	36	0
Untreated	20	10	1.05 \pm 0.24	11	0	89	24	0
Untreated virgin	24	0	0.86 \pm 0.36	21	17	62	—	—

whereas intermediate values were rather scarce. In order to clarify these data, oocyte length values have been classified into three categories: PV: previtellogenic oocytes (0.10-0.37 mm); VO: vitellogenic oocytes (0.38-1.00 mm) and DO: fully developed oocytes (> 1.00 mm).

In all cases EP2 proved to be the most active compound followed by P2 and P1, as can be seen in table I when results of experiments using the same dose and causing low mortality (1 $\mu\text{g}/\text{cm}^2$) are compared. These structure-activity relationships are in agreement with those previously reported on the morphogenetic experiments (2). The observed oocyte growth inhibition should be considered primarily as a consequence of the allatocidal action of Precocenes, thus resulting in deficiencies in juvenile hormone levels and in a failure of vitellogenesis (3, 4). However, results on oocyte growth inhibition obtained on those experiments with high degree of mortality (25 and 10 $\mu\text{g}/\text{cm}^2$ of P1, or 10 and 5 $\mu\text{g}/\text{cm}^2$ of P2) could also be interpreted as due to side toxic effects of Precocenes in addition to those derived from allatocidal action.

Furthermore, the possible influence of Precocenes on mating should also be considered since virgin females showed smaller oocyte length values (table I). In this context, we have previously observed that Precocenes modify the sexual behaviour of *O. lavaterae*, inducing a slight mating decrease (1). Nevertheless, these

moderate effects are not enough to explain the considerable degree of inhibition herein reported.

Resumen

Se describe la actividad antigonadotrópica inducida por el Precoceno 1 (P1), Precoceno 2 (P2) y Etoxiprecoceno 2 (EP2), sobre el heteróptero *Oxycarenus lavaterae* (F.) (*Heteroptera, Lygaeidae*). El EP2 es el más activo, seguido del P2 y del P1, coincidiendo con los datos de estructura-actividad generalmente reportados para estos compuestos. También se estudia la mortalidad inducida en ambos sexos por estos compuestos, siendo el P2 el de mayor toxicidad. Los machos son más sensibles a dichos efectos tóxicos.

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