Biosynthesis and Interconversion of Phytoecdysones in *Sesuvium Portulacastrum* L.†

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Summary Incorporation of mevalonic acid and cholesterol into ecdysone and ecdysterone and conversion of ecdysone into ecdysterone in the plant, *Sesuvium portulacastrum* L., have been demonstrated.

THE biosynthetic and metabolic transformations of ecdysones have been studied in several insects, but investigations on the biosynthesis in plants are few and restricted to lower plants.[1] The co-occurrence of ecdysone and ecdysterone in

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a higher plant, *viz. Sesuvium portulacastrum* L. (N.O. Aizoaceae),[2] presented an attractive possibility for a study of their biosynthesis and interconversion. We report here the incorporation of mevalonic acid and cholesterol into ecdysone and ecdysterone and also conversion of ecdysone into ecdysterone in *S. portulacastrum* L.

The labelled substrates (in aqueous or 10% aqueous ethanolic solution) were administered to the plant by the wick method. The plants were harvested after two weeks and worked up for the isolation of ecdysones.[3] Ecdysone and ecdysterone could be separated by preparative t.l.c. The two compounds were identified by u.v. and t.l.c. comparisons with authentic samples.[2] Further, their acetates (Ac_2O–pyridine; 16 h at 30°) were identical with authentic samples. Radiochemical purity was checked by isotopic dilution.

Substrate	Activity given		Products					
			Ecdysterone			Ecdysone		
	Total activity d.p.m.	Sp. activity d.p.m./mM	d.p.m.	% Incorpn.	Sp. activity d.p.m./mM	d.p.m.	% Incorpn.	Sp. activity d.p.m./mM
Sodium [2-^{14}C]acetate	$5{\cdot}5 \times 10^8$	$5{\cdot}1 \times 10^{10}$	$2{\cdot}6 \times 10^4$	0·005	$3{\cdot}8 \times 10^6$	$3{\cdot}1 \times 10^3$	0·0006	$4{\cdot}6 \times 10^6$
Mevalonic acid [2-^{14}C]lactone	$2{\cdot}2 \times 10^8$	$1{\cdot}1 \times 10^{10}$	$2{\cdot}4 \times 10^6$	1·1	$9{\cdot}6 \times 10^7$	$2{\cdot}1 \times 10^5$	0·1	$1{\cdot}4 \times 10^8$
[4-^{14}C]Cholesterol	$1{\cdot}1 \times 10^8$	$1{\cdot}2 \times 10^{11}$	$1{\cdot}0 \times 10^4$	0·009	$1{\cdot}4 \times 10^5$	$5{\cdot}2 \times 10^3$	0·005	$1{\cdot}3 \times 10^6$
[*U*-^{3}H]-Δ^4-Cholesten-3-one	$5{\cdot}7 \times 10^8$	$3{\cdot}1 \times 10^{11}$	No activity	—	—	No activity	—	—
[*U*-^{3}H]Ecdysone	$1{\cdot}3 \times 10^9$	$1{\cdot}7 \times 10^{12}$	$1{\cdot}4 \times 10^7$	1·1	$1{\cdot}3 \times 10^9$	$4{\cdot}0 \times 10^7$	3·1	$1{\cdot}2 \times 10^{10}$
[*U*-^{3}H]Ecdysterone	$1{\cdot}3 \times 10^9$	$2{\cdot}0 \times 10^{12}$	$2{\cdot}5 \times 10^8$	19·2	$6{\cdot}8 \times 10^9$	No activity	—	—

In the first instance two general precursors, *viz.* [2-^{14}C]-acetate and -mevalonic acid were fed to *S. portulacastrum* L.; ecdysterone and ecdysone were isolated and found to possess radioactivity. Plants administered with [4-^{14}C]-cholesterol were also found to give labelled ecdysone and conversion of ecdysone into ecdysterone in arthropods provides evidence for hydroxylation at C-20 position.[7] In our experiment clear evidence for the hydroxylation of C-20 was obtained as [^{3}H]ecdysone was efficiently converted into [^{3}H]ecdysterone. The possibility of equilibrium between ecdysone and ecdysterone is ruled out since ecdysone obtained from [^{3}H]ecdysterone administered *S. portulacastrum* was inactive.

ecdysterone. Incorporation was rather low. Since Δ^4-3-ketones are known to be intermediates in the transformation of Δ^5- to 5-βH steroids in animals[4] as well as in plants,[5] the possible incorporation of Δ^4-[^{3}H]cholesten-3-one into ecdysone and ecdysterone was explored. The absence of incorporation in the two phytoecdysones suggests that a different biosynthetic mechanism is operating in *S. portulacastrum* L.

In the insects, at least two modes of metabolic transformation of ecdysones have been reported. The experiments of Carlisle and Ellis on locusts suggest that ecdysone is deactivated by dehydroxylation.[6] On the other hand,

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