

Biosynthesis and Catabolism of Caffeine in Low Caffeine-containing Species of *Coffea*

H. ASHIHARA¹, A. CROZIER²

¹Department of Biology, Faculty of Science, Ochanomizu University, 2-1-1, Otsuka,
Bunkyo-ku, Tokyo 112-8610, Japan

²Division of Biochemistry and Molecular Biology, Institute of Biomedical and Life Sciences,
University of Glasgow, Glasgow G12 8QQ, UK

SUMMARY

Leaves of *Coffea salvatrix*, *C.eugenoides* and *C.bengalensis* contain ca. 3-7-fold lower levels of caffeine than those of *C.arabica*. There was more extensive biosynthesis of caffeine from [8-¹⁴C]adenine in young leaves of *C. arabica* than in *C.salvatrix*, *C.eugenoides* and *C.bengalensis*. Degradation of [8-¹⁴C]caffeine, which is negligible in leaves of *C.arabica*, was also very slow in *C.salvatrix* and *C.bengalensis*. In contrast, [8-¹⁴C]caffeine was catabolised rapidly by young leaves of *C.eugenoides* primarily by a caffeine → theophylline → 3-methylxanthine → xanthine → uric acid → allantoin → allantoinic acid → urea → CO₂ + NH₃ pathway. These results indicate that the low caffeine accumulation in *C.salvatrix*, *C.eugenoides* and *C.bengalensis* is a consequence a slow rate of caffeine biosynthesis while rapid degradation of caffeine also contributes to the low endogenous caffeine pool in *C.eugenoides*. The genes that regulate caffeine accumulation appear to be those encoding N-methyltransferase and caffeine (7-N) demethylase activities.