

ADAPTIVE RESPONSES OF *Piper batle*, L.  
(DAMP SPIKE) UNDER DROUGHT STRESS

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**ANTIOXIDATIVE RESPONSES OF *Piper betle*, L. (DAUN SIRIH) UNDER  
PARAQUAT STRESS**

By  
Muhamad Hazwan bin Mat Tar

A thesis submitted in partial fulfillment of  
the requirement for the award of the degree of  
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**DEPARTMENT OF BIOLOGICAL SCIENCES  
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**PENGAKUAN DAN PENGESAHAN LAPORAN  
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Adalah ini diakui dan disahkan bahawa laporan peyelidikan bertajuk: **ANTIOXIDATIVE RESPONSES OF *Piper Betle* , L (DAUN SIRIH)** oleh **MUHAMAD HAZWAN BIN MAT TAR**, No Matrik: **UK12022** telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Biologi sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah **SARJANA MUDA SAINS (SAINS BIOLOGI)** Fakulti Sains dan Teknologi, Universiti Malaysia Terengganu.

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## DECLARATION

I hereby declare that this thesis entitled Antioxidative Responses of *Piper betle*, L. (daun sireh) Under Paraquat Stress is the result of my own research except as cited in the references.

Signature



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## ABSTRACT

Antioxidants include enzymatic and non-enzymatic antioxidant as well as bioactive plant phenols. The health benefits of this *Piper betle* are largely due to antioxidant vitamin supported by large number of phytochemicals, some with greater antioxidant properties. The objective of this study is to determine the effects of oxidative stress induced by paraquat (PQ) on the level of antioxidative constituents (carotenoid, ascorbic acid, and  $\alpha$ -tocopherol) in *Piper betle*. Leaf disc of *Piper betle* were treated with different concentrations of PQ (0, 15, 30, 60  $\mu$ M) for 7 days. At the earlier stages of PQ treatment, increasing of PQ concentrations enhanced the level of non-enzymatic antioxidants compared to control. Excess PQ application (60 $\mu$ M) lowered the ascorbic acid, carotenoid, and  $\alpha$ -tocopherol concentration. Results revealed that PQ induced the oxidative stress in *Piper betle*.



## ABSTRAK

Antioksidan termasuk antioksidan berenzim dan bukan enzim dan juga bioktif fenol pada tumbuhan. *Piper betle* mempunyai kelebihan dari segi kesihatan kerana mengandungi vitamin antioksidan dan kandungan fitokimia yang tinggi. Objektif kajian ini adalah untuk mengkaji kesan tegasan oksidatif oleh parakuat ke atas kandungan antioksidan (karotenoid, asid askorbik, dan  $\alpha$ -tokoferol) dalam *Piper betle*. Disk daun *Piper betle* dirawat dengan PQ pada kepekatan yang berbeza (0, 15, 30, 60  $\mu$ M) selama 7 hari. Pada peringkat awal kajian, peningkatan kepekatan PQ meningkatkan kandungan antioksidan bukan enzim berbanding dengan kawalan. Kepekatan PQ yang tinggi (60 $\mu$ M) menurunkan kandungan asid askorbik, karotenoid, dan  $\alpha$ -tokoferol. Kajian ini menunjukkan bahawa PQ merangsang tegasan oksidatif di dalam *Piper betle*.