

ผลของแคดเมียมต่อการตอบสนองทางสรีรวิทยาของพืชบางชนิด

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EFFECTS OF CADMIUM ON PHYSIOLOGICAL RESPONSES
OF SOME PLANTS

Mr. Supat Posayawattanakul

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Environmental Science

Inter-Department of Environmental Science

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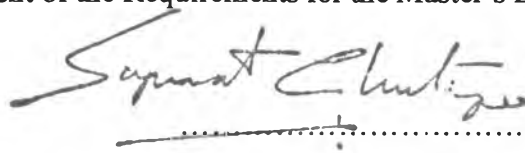
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Thesis Advisor Associate Professor Thaweesakdi Boonkerd, Ph.D.

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.....Dean of Graduate School
(Professor Supawat Chutivongse, M.D.)

Thesis Committee



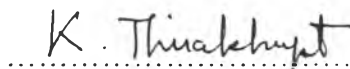
.....Chairman
(Assistant Professor Pipat Patanaponpaiboon, Ph.D.)



.....Thesis Advisor
(Associate Professor Thaweesakdi Boonkerd, Ph.D.)



.....Member
(Associate Professor Preeda Boon-Long, Ph.D.)



.....Member
(Assistant Professor Kumthorn Thirakhupt, Ph.D.)

สุพัฒน์ โปษะวัฒนากุล : ผลของแคดเมียมต่อการตอบสนองทางสรีรวิทยาของพืชบางชนิด
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งานวิจัยนี้ศึกษาการตอบสนองทางสรีรวิทยาของผักและวัชพืชอย่างละ 2 ชนิด ซึ่งได้แก่ ผักบั้งจีน (*Ipomoea aquatica* Forsk.) ผักคะน้า (*Brassica oleracea* L. cv. Group Chinese Kale) กะเม็ง (*Eclipta prostrata* L.) และหญ้าฝรั่ง (*Chloris barbata* Sw.) เมื่อได้รับแคดเมียมที่ความเข้มข้น 5 และ 20 มิลลิกรัมต่อลิตร โดยพืชจะได้รับแคดเมียมในช่วงเวลาที่ต่างกัน ได้ศึกษาการสะสมโพรลิน ปริมาณคลอโรฟิลล์ ปริมาณน้ำในพืช การเจริญเติบโต ตลอดจนปริมาณแคดเมียมที่สะสมในส่วนรากและส่วนต้นของพืช

ผลการศึกษาแสดงให้เห็นว่าพืชมีการสะสมโพรลินเมื่อได้รับแคดเมียม อย่างไรก็ตามผลการศึกษานี้ได้บ่งถึงความไม่เหมาะสมในการใช้ปริมาณโพรลินสะสมเพื่อเป็นดัชนีแสดงถึงการได้รับแคดเมียม ในส่วนของปริมาณคลอโรฟิลล์ ปริมาณน้ำในพืช และการเจริญเติบโต พบว่ามีการลดลงซึ่งเป็นผลจากการได้รับแคดเมียม สำหรับปริมาณสะสมในส่วนรากและส่วนต้นนั้น พบว่ามีความสัมพันธ์กันอย่างมีนัยสำคัญทางสถิติที่ระดับความเชื่อมั่น 99 เปอร์เซ็นต์ ในการศึกษาการตอบสนองของพืชแต่ละชนิด แสดงให้เห็นว่าผักคะน้ามีความทนทานและมีการสะสมแคดเมียมมากที่สุด

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This study investigated the physiological responses of two vegetable species, Kangkong (*Ipomoea aquatica* Forsk.) and Chinese Kale (*Brassica oleracea* L. cv. Group Chinese Kale), together with two weed species, False daisy (*Eclipta prostrata* L.) and Swollen finger grass (*Chloris barbata* Sw.) under Cd stress. These plants were exposed to 5 and 20 ppm Cd-containing solution with different exposure time. Proline accumulation, chlorophyll contents, Relative Water Content (RWC) and plant growth were determined against Cd accumulation both in roots and in shoots.

The results have shown that proline is accumulated in Cd-stressed plants. However, the findings imply that proline accumulation is not an effective indicator of Cd stress. Unlike proline, chlorophyll contents, RWC and plant growth are adversely affected by Cd. Strong correlation ($P \leq 0.01$) between root and shoot Cd content were observed. As for the responses of each species, it was evident that Chinese Kale was the greatest Cd accumulator as well as the most tolerant species.

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ลายมือชื่อนิสิต Supat Posayawattanakul

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ลายมือชื่อคณาจารย์ที่ปรึกษาร่วม -

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ABBREVIATIONS AND UNITS

2d	= 2 days of 5 or 20 ppm Cd exposure
11d	= 11 days of 5 ppm Cd exposure
20d	= 20 days of 5 ppm Cd exposure
7d (27)	= 7 days of transfer to new Cd-free solution after 20 days of 5 ppm Cd exposure or the 27 th day of treatment
14d (34)	= 14 days of transfer to new Cd-free solution after 20 days of 5 ppm Cd exposure or the 34 th day of treatment
5d	= 5 days of 20 ppm Cd exposure
8d	= 8 days of 20 ppm Cd treatment
7d (15)	= 7 days of transfer to new Cd-free solution after 8 days of 20 ppm Cd exposure or the 15 th day of treatment
14d (22)	= 14 days of transfer to new Cd-free solution after 8 days of 20 ppm Cd exposure or the 22 nd day of treatment
$\mu\text{g/g}$	= Microgram per gram
μM or μmol	= Micromole
ANOVA	= Analysis of variance
C/N	= Carbon per nitrogen
CEC	= Cation Exchange Capacity
Chl	= Chlorophyll
CRD	= Completely randomized design
cm^3	= Cubic centimeter
DMRT	= Duncan's Multiple Range Test
DW	= Dry weight
EC	= European Community
FW	= Fresh weight
Fig	= Figure
g	= gram
Ha	= Hectare

m	= Meter
M	= Mole
mg/l	= Milligram per liter
mm	= Millimeter
nm	= Nanometer
rpm	= round per minute
R/S Ratio	= Root to Shoot Ratio
RH	= Relative humidity
SL	= Significance Levels
TW	= Turgid weight