

題號： 231

國立臺灣大學 114 學年度碩士班招生考試試題

科目： 園藝作物生理學

題號：231

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一、解釋下列名詞：(20 分，每小題 4 分)

1. Flowering process
2. Light respiration
3. Photomorphogenesis
4. Photosystem II
5. Physiological drought

二、試述氣孔開閉之機制為何？常態下，保衛細胞內的二氧化碳、酸鹼值、鉀離子濃度和水勢狀況會如何變化使氣孔開放？(10 分)

三、試述植物缺乏氮、鉀、鎂或鐵的症狀與 top-root ratio 變化為何？(10 分)

四、試述植物賀爾蒙 IAA、GA 和 Cytokinin 對植物生理效應有何異同？(10 分)

五、請閱讀以下報告後，以中文回答下列問題：(25 分)

To determine the effects of drought stress, especially light drought stress, on flower number in *Passiflora edulis*, one-year-old plants grown in 7.5 L plastic pots were subjected to different soil water content treatments, namely wetness, light drought, and heavy drought for two months. Average, maximum, and minimum soil water contents (v/v) were 44, 47, and 41% in the wetness treatment, 23, 40, and 11% in the light drought treatment and 11, 33, and 6% in the heavy drought treatment. Flower number decreased as the strength of drought stress increased, although the number of nodes and flower buds did not. Flowering periods were from June 27 to July 19 in the wetness treatment and June 26 to July 16 in the light drought treatment with three peaks around July 1, 6, and 13. In the heavy drought treatment, the flowering period was from July 11 to 18 with one peak. The flower bud number was not affected by drought stress. Light drought stress did not suppress vegetative growth, such as vine length, leaf number, leaf length, or photosynthetic rate, although heavy drought stress did. Stomatal conductance was suppressed by light drought only at 12:00PM and by heavy drought throughout the day. Leaf water potential was decreased by heavy drought at 3:00PM, but not by light drought. In the wetness and light drought treatments, visible wilting was not observed, and in the heavy drought treatment the plants wilted before irrigation, although they recovered about 15 min after irrigation. In conclusion, even light drought stress, which did not suppress vegetative growth, reduced the flower number in *Passiflora edulis*. Drought stress suppressed flower bud development but not differentiation.

1. 本試驗所用的植物材料中文名為何？(2.5 分) 其開花生理之日長反應屬於哪一類？(2.5 分)

見背面

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2. 請表列試驗結果之輕度缺水與重度缺水植物表現上之差異。(10 分)
3. 請由試驗結果推論所用的植物之 permanent wilting point。(5 分)
4. 本試驗如何得到「Drought stress suppressed flower bud development but not differentiation」這個結論？(5 分)

六、請閱讀以下報告後，以中文回答下列問題：(25 分)

Rising temperature extremes during critical reproductive periods threaten the yield of major grain and fruit crops. Flowering plant reproduction depends on the ability of pollen grains to generate a pollen tube, which elongates through the pistil to deliver sperm cells to female gametes for double fertilization. We used *Solanum lycopersicum* as a model fruit crop to determine how high temperature affects the pollen tube growth phase, taking advantage of cultivars noted for fruit production in exceptionally hot growing seasons. We found that exposure to high temperature solely during the pollen tube growth phase limits fruit biomass and seed set more significantly in thermosensitive cultivars than in thermotolerant cultivars. Importantly, we found that pollen tubes from the Tamaulipas cultivar have enhanced growth *in vivo* and *in vitro* under high temperature. Analysis of the pollen tube transcriptome's response to high temperature allowed us to define two response modes (enhanced induction of stress responses and higher basal levels of growth pathways repressed by heat stress) associated with reproductive thermotolerance. Importantly, we define key components of the pollen tube stress response, identifying enhanced reactive oxygen species (ROS) homeostasis and pollen tube callose synthesis and deposition as important components of reproductive traits in Tamaulipas. Our work identifies the pollen tube growth phase as a viable target to enhance reproductive thermotolerance and delineates key pathways that are altered in crop varieties capable of fruiting under high-temperature conditions.

1. 本試驗所用的作物中文名為何？(2.5 分)；另請列出一個同屬之園藝作物。(2.5 分)
2. 本試驗認為在生殖生長過程中，那一個階段的耐熱性對該作物產量影響最大？(5 分)
3. 從本試驗的結果描述，所用的「Tamaulipas」品種為 thermosensitive 或 thermotolerant？(5 分)
4. 承上，在影響生殖生長耐熱性的關鍵階段，「Tamaulipas」這個品種有什麼特別的地方？(5 分)
5. 作物生理上，有那兩種礦物元素對文中所稱之生殖生長耐熱性關鍵階段有重要影響？(5 分)

試題隨卷繳回