Bryophyllum pinnatum Kurz. – A NEW CUT FLOWER SPECIES. II. VASE LIFE.

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SUMMARY

This paper presents results of evaluation of keeping flowering stems of *Bryophyllum pinnatum* Kurz. in dry and wet vase, under ordinary room conditions, with S and N window exposition (2x2 factorial treatment design; 5 replicates; 1 stem was the experimental unit). The experiment was conducted in February for 3 weeks, using stems cut in their natural habitat. The results indicate that the stems kept in the wet and dry vase continued flowering. Better hydration was secured with stems kept in wet vase and in southern window exposition. Long appreciation of aesthetic values of both, the open flowers and the buds, was secured with flowering continuing up to three weeks. The results indicate, that flower development from mature buds is independent from the water status of the stem and, seems to depend, upon the state of flower hydration itself. The calyx may play a crucial role in protecting the internal water status of developing flowers.

ADDITIONAL KEY WORDS: postharvest, ornamental flower, inflorescence.

Bryophyllum pinnatum Kurz. – UNA ESPECIE NUEVA DE FLOR DE CORTE. II. VIDA EN FLORERO

RESUMEN

Este trabajo presenta los resultados de evaluación de tallos florales de *Bryophyllum pinnatum* Kurz.manteniéndolos en vaso seco o en vaso con agua, en condiciones de un cuarto ordinario, con exposición de las ventanas al sur y al norte (diseño de tratamientos factorial 2x2; 5 repeticiones; 1 tallo forma una unidad experimental). El experimento fue conducido en febrero durante 3 semanas, utilizando tallos florales cortados en su habitat natural. Los resultados indican que las dos formas de mantenimiento de tallos florales, es decir, en seco y en el agua presentaron una continua floración; asimismo una mejor hidratación fue asegurada manteneniendo los tallos en agua y una exposición de la ventana al sur. La larga apreciación de los valores estéticos, en las flores abiertas y en los botones, fue asegurada con una continua floración de hasta tres semanas. Los resultados indican que el desarrollo de las flores de los botones maduros es independiente del estado hídrico del tallo y parece depender del estado hídrico de las flores mismas. El caliz puede desempeñar un papel crucial en la protección del estado hídrico interno de las flores en desarrollo.

PALABRAS CLAVE ADICIONALES: postcosecha, flor ornamental, inflorescencia.

INTRODUCTION

Efficient water conservation was found in *Kalanchoe blossfeldiana* (Zabka and Chaturvedi, 1975). The cut inflorescences of *K. quartiniana* A. Rich. were kept for more than two weeks under standarized laboratory conditions (Bredmose, 1987). Considering the CAM metabolism of *Bryophyllum pinnatum* one expects that its inflorescence would have acceptable vase life, although some doubts were expressed by the consumer upon the acceptance of the genus *Kalanchoe* due to the low number of opened flowers at any time in the representatives of the genus, with upright flowers, and *Bryophyllum* or *Kitchingia* sections with dropping flowers; *B. pinnatum* was not mentioned by (Kroon *et al*., 1989). *Kalanchoe blossfeldiana* is widely offered as pot plant only.

The former paper (Leszczyñska-Borys *et at.,* 2002) dealt with the aesthetic value of *Bryophyllum pinnatum* (common name – "los botonsitos"). The present paper deals with the results of an experiment to evaluate vase life of flowering stems under ordinary house conditions.

MATERIALS AND METHODS

Stems originated in Xalapa, Veracruz from a wild stand were wrapped in newspaper to protect them from direct

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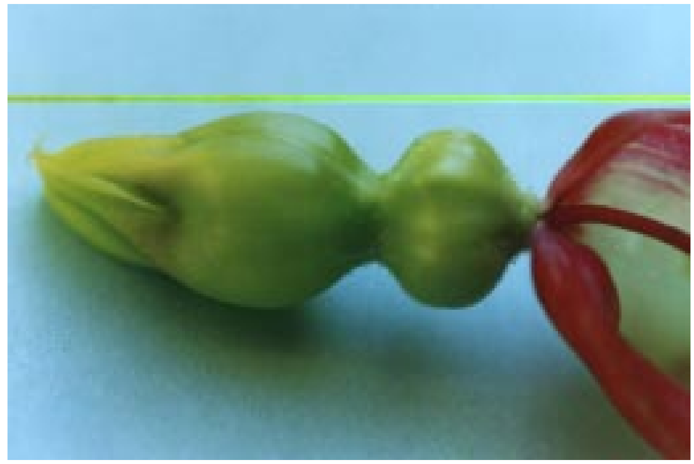
sun radiation and transported for 4 hours to Puebla, México under hot and dry air of the car. The stems were recut. Leafless stems were used. The following treatments were tested: 1) stems placed in tap water and exposed to the southern window, 2) stems placed in tap water and exposed to the northern window, 3) stems placed in a dry vase and exposed to the southern window, 4) stems placed in a dry vase and exposed to the northern window. A factorial treatment design was applied, with five replicates per treatment, one stem being the experimental unit.The variance analysis was done, and the Tukey´s pairwise comparisons to judge the treatment effects were carried out.

Room temperature varied from 16 to 18 °C and from 18 to 24 °C (night/day). Relative humidity varied from 64 to 54 % (N/D). Light conditions were: in southern window the sun light was reaching the inflorescences from 11:00 to 15:00 and in the northern window only diffuse sun light was available. The internal water status of flowering stems was determined at the end of observations by drying each component for 48 hours at 70 °C. The components distinguished were: stem's basal part (below the point the first lateral inflorescence appeared), stem's part from which the lateral inflorescences appeared (stem of the inflorescence), peduncles, open flowers, buds (calyces closed = unopened flowers), closed flowers. The term "all flowers" included buds, flowers opened, flowers closed; the term "inflorescence" included flowering structures, peduncle and the stem of the inflorescence only.

RESULTS AND DISCUSSION

Stems should be free from large, heavy, brittle leaves in order to reduce water loss and to make easier their postharvest handling. The hanging flowers and the fragile peduncles make the handling somehow a difficult task. Aphids may show up in vase kept stems due to prolonged vase life. The prolonged transportation in high temperatures resulted in water stress of undeveloped buds. These conditions did not affect flower opening from mature buds and did not lowered the aesthetic value of the flowering stem. It is interesting to note the differences in coloration of buds from stems originated from a greenhouse covered with a plastic roof and those grown under open field conditions (Figures 1, 2, 3, 4, 5).

The final fresh mass of stems components was not influenced significantly by the two weeks of treatment, with the exception of fresh mass of buds and of one bud (Tables 1, 2). There was only a tendency of the mass to decreaseof stems under the dry vase conditions. This was due to the death of the parenchymatous tissue, at a distance up to 75 % of the total stem length, in stems held under dry vase conditions, whereas in stems kept in water only 10 cm of the stem base was dead. Thus, one may argue that the continuity of water column was affected.



Figures 1, 2. Buds of flowering stems from plants of *Bryophyllum pinnatum* Kurz. grown under plastic roof are pale green. The corolla of emerging flowers shows red color, typical to stems grown in the field conditions. The flower itself, until it is covered by the papery calyx remains green. There is a difference in light requirements to develop the red color by the calyx and emerging corolla.

The fresh mass of open or closed flowers was also not significantly influenced. Only the fresh mass from stems held under dry vase treatment and in the northern exposition was higher. Also, the treatments were without significant influence upon the flowering advance (Table 3), although a clear tendency was to give higher percent of lateral inflorescences under the southern exposition (Table 4). Keeping the stems in the wet vase, as compared to the dry vase, resulted in higher water content in the stems. Under

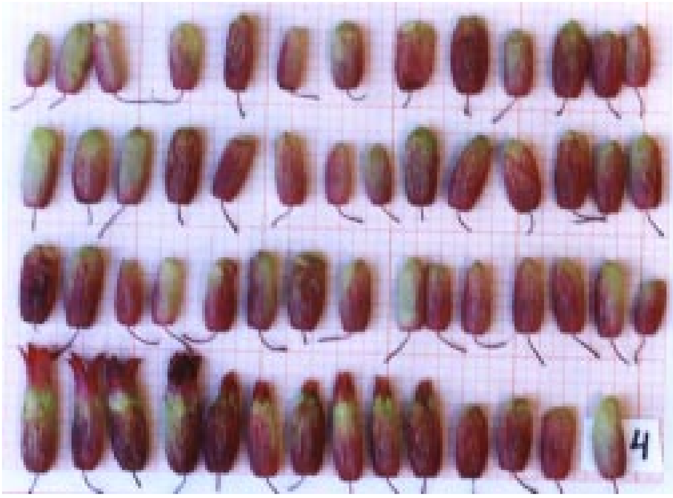
Figures 3, 4, 5. Calyces from plants of *Bryophyllum pinnatum* Kurz. grown under open field conditions developed the red coloration whereas the flower itself remains green until the calyx structure ruptures. Only that part of corolla exposed to light attains red coloration. Thus, the calyx eliminates a part of light energy from growing receptacle.

the dry vase there was no significant effect of the windows exposition (Table 5). I was found, however, a significant difference in the hydration of stem components, being higher in flowers (Table 6). Their hydration depends upon the flowers development, being higher in the open flowers (Table 7). The loss of water by the flowering stems during three weeks was higher in stems kept under the dry vase and lower under the wet vase and the southern exposition (Table 8). This suggests that positive influence upon the flowering response of lateral inflorescences was due to the better hydration of developing flowers.

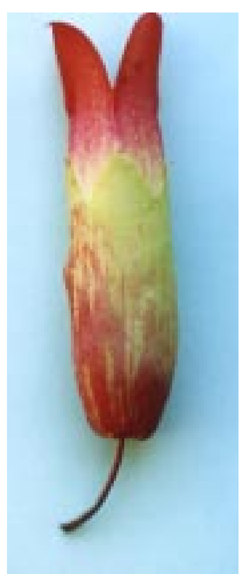
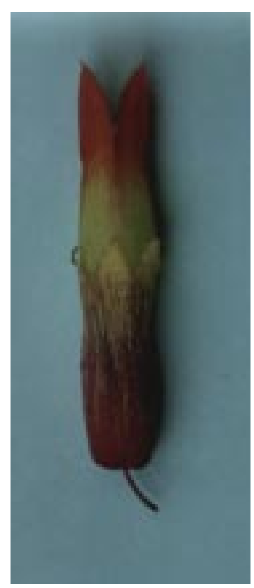
The buds seem to behave independently upon the water status of the remaining parts of the flowering stems. Such a conclusion is supported by the development of buds, detached from the peduncle, into the open flowers (Figure 6, 7, 8). This indicates, that the flower development is independent upon water status of the rest of the flowering stem. It seems to be related to the CAM – metabolism, with strongly accentuated control of hydration and very efficient energy conservation in a developing flower. This flower may have a special metabolism to protect its internal water status. The calyx may have such a function.

The continuity of flowers opening, even under the dry vase, during three weeks of observation (Figures 12,13), suggests that inflorescences of CAM species may be used successfully as cut flowers for wet or dry vase keeping under home conditions, without the fear to show sudden loss in aesthetic appreciation, at least for two weeks. Having 48.3 % of flowers at a closed stage, at the end of third week, the stems reached their final capacity to generate the specific beauty of the inflorescence.

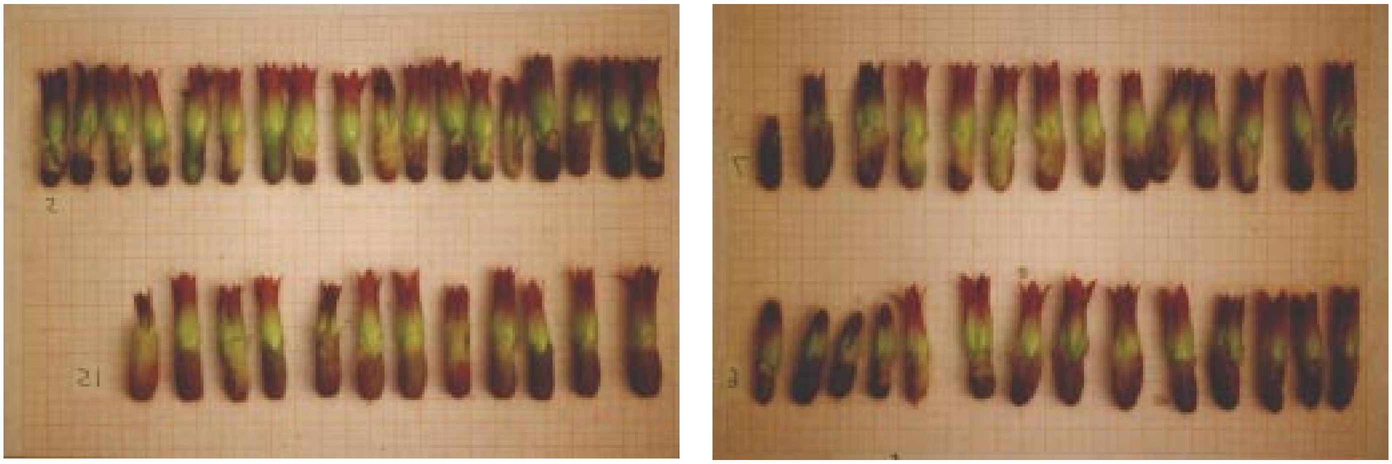
The vase life, reached under our uncontrolled environment (temperature, light and relative humidity), was similar to the results of Bredmose (1987) and Kroon *et al*. (1989) for other representatives of this genus. This seems to be conditioned by the same metabolism of their flowers and developing buds, which seems to be independent upon the water status of other components of the flowering stems. Newertheless, the better water status of flowering stems, in the southern exposition in stems kept in water (Table 5 and 8), should be taken into account as a technical mean of lowering water losses and securing better flowering of lateral inflorescences.



Figures 6, 7, 8. From one flowering stem of *Bryophyllum pinnatum* Kurz. all buds and flowers were detached from peduncles and exposed for two weeks to ordinary room conditions in diffuse light of N window exposition. Photos were taken at weekly intervals: a) 12.02.00 - beginning of observations; b) 19.2.00 – some flowers are closed, others advanced their growth and some new flowers emerged from buds; c) 27.2.00 – some flowers still were growing and the most of buds remained alive.

Figures 9, 10, 11. Photoghaphs ilustrating flowers emergence of *Bryophyllum pinnatum* Kurz. from a closed bud. The developing flower is completely covered by the papery bud (9). The papery calyx is stickig fast to the emerging corolla (10,11) until the anthesis is over. Afterwards, the corolla collapses leaving a space, between the flowers remainings and the calyx (Fig. 7, 8 botom left row). The collapsed corolla forms a cover tightly adhering to the receptacle.



Figures 12, 13. Open flowers of *Bryophyllum pinnatum* Kurz. detached from stems under the third week of treatment: (5) – dry vase and southern exposition; (15) – wet vase and southern exposition; (6) – dry vase and northern exposition; (7) – wet vase and northern exposition. The size of flowers is similar, although length of corolla is greatly reduced as compared to flowers of freshly cut stems.

The morphological events accompanying the macrochanges in developing flowers of *B. pinnatum* (Figures 9, 10, 11, 12, 13) seem to be related to the observed continuity of flowers emergence in flowering stems kept in the water or in the dry vase, of both exposition sites, the sunny and diffuse daily light. The species belongs to plants of CAM metabolism. Its open and closed flowers preserved high water status. The flowers were still growing, although they were detached from peduncles for 14 days, kept in varying temperature and relative air humidity. It seems that the morphological attributes of developing flowers partially explains the high water content of flowers. The closed calyx, forming the first cover could reduce water transpiration and, later, the collapsed corolla covering the receptacle, formed the second obstacle to water losses. The later cover of corolla was less efficient in preventing transpiration. The energy and the water saving mechanism secured independent development of mature buds into flowers, even when detached from peduncles. It is necessary to proof experimentaly the functioning of CAM metabolism and high presence of low transpiration/ photosynthesis ratio in buds, open flowers, peduncles and to clearify the function played by the closed calyx in gas exchange.

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