

THE EFFECT OF SELECTED FACTORS ON MICROPROPAGATION EFFICACY AND ON THE FIRST BULB YIELD IN *HIPPEASTRUM* × *CHMIELII* CHM. AND *H. HYBRIDUM* ‘DOUBLE ROMA’

Dariusz Sochacki*, Emilia Woźniak, and Przemysław Marciniak

Department of Ornamental Plants, Faculty of Horticulture, Biotechnology and Landscape Architecture,
Warsaw University of Life Sciences (SGGW), 166 Nowoursynowska str., 02-787 Warsaw, Poland,

*Fax: + 48 22 59 322 68, *E: dariusz_sochacki@sggw.pl

REFERENCES

- ARTEAGA AMADOR M., PENA GARCIA E., PEREZ MONTESINO D., TORRIENTE CAMPOS D., KANG CHOLGYU Z. (1998). Disinfection of *Hippeastrum vittatum* explants as a determining factor for large scale propagation with commercial aims in Cuba. *Revista del Jardín Botánico Nacional*, 19: 103-111 (in Spanish).
- ASCOUGH G. D., ERWIN J. E., VAN STADEN J. (2008). Reduced temperature, elevated sucrose, continuous light and gibberellic acid promote corm formation in *Watsonia vanderspuyiae*. *Plant Cell, Tissue and Organ Culture*, 95: 275-283.
- BACH A., PTAK M. (1997). Effect of light quality on regeneration of hippeastrum (*Hippeastrum hybridum*) *in vitro*. *Zeszyty Naukowe Akademii Rolniczej w Krakowie*, 318: 191-193 (in Polish).
- BATTACHARYYA D., BABGOHARI M. Z., RATHOR P., PRITHIVIRAJ B. (2015). Seaweed extracts as biostimulants in horticulture. *Scientia Horticulturae*, 196: 39-48.
- BRYAN J. E. (2002). *Hippeastrum - Amaryllidaceae*. In: Bryan J. E., *Bulbs*. Timber Press, Portland, Oregon, USA: 281-283.
- CHMIEL H., ILCZUK A., ŁUKASZEWSKA A. (2002). All-round merits of a new *Hippeastrum* hybrid. *Flower Tech*, 5: 31-33.
- CRAIGIE J. S. (2011). Seaweed extract stimuli in plant science and agriculture. *Journal of Applied Phycology*, 23: 371-393.
- GABRYSZEWSKA E. (2010). The effects of glucose and growth regulators on the organogenesis of *Paeonia lactiflora* Pall. *in vitro*. *Journal of Fruit and Ornamental Plant Research*, 18: 309-320.
- GABRYSZEWSKA E., SOCHACKI D. (2013). Effect of various levels of sucrose and nitrogen salts on the growth and development of lily bulblets *in vitro*. *Acta Horticulturae*, 1002: 139-145.
- HONG L., LEE A. K. (2012). Micropropagation of *Cyrtanthus* ‘Orange Gem’ × *C. eucallus* hybrid. *Scientia Horticulturae*, 142: 174-179.
- ILCZUK A., WINKELMANN T., RICHARTZ S., WITOMSKA M., SEREK M. (2005). *In vitro* propagation of *Hippeastrum* × *chmielii* Chm. – influence of flurprimidol and the culture in solid or liquid medium and in temporary immersion systems. *Plant Cell, Tissue and Organ Culture*, 83: 339-346.
- KHAN W., RAYIRATH U. P., SUBRAMANIAN S., JITHESH M. N., RAYORATH P., HODGES D. M., CRITCHLEY A. T., CRAIGIE J. S., NORRIE J., PRITHIVIRAJ B. (2009). Seaweed extracts as biostimulants of plant growth and development. *Journal of Plant Growth Regulators*, 28: 386-399.
- KLARZYŃSKI O., FABIET E., EUZE M., JOUBERT J.-M. (2006). Mode of action of algae extract: what we know today. Extract from *Phytoma* – La Defense des Vegetaux, 597, October 2006. [<http://www.goemar.com/sites/default/files/fichiers/atriclephytomanutritionphosphateuk597.pdf>] [on-line 05-09-2018].
- KUTYLA M., CHMIEL H. (2000). Influence of medium and size of twin-scales on propagation of *Hippeastrum* × *hybridum* *in vitro*. *Zeszyty Naukowe Instytutu Sadownictwa i Kwiaciarnictwa*, 7: 249-254 (in Polish).
- LANGENS-GERRITS M. M., KUIJPERS A. M., DE KLERK G. J., CROES A. (2003). Contribution of explant carbohydrate reserves and sucrose in the medium to bulb growth of lily regenerated on scale segments *in vitro*. *Physiologia Plantarum*, 117: 245-255.
- ŁUKASZEWSKA A., ILCZUK A. (2001). Flower longevity of a new interspecific hybrid of *Hippeastrum* × *chmielii*. *Folia Horticulturae*, 13/1A: 617-624 (in Polish).
- MEEROW A. W., VAN SCHEEPEN J., DUTILH J. H. A. (1997). Transfers from *Amaryllis* to *Hippeastrum* (Amaryllidaceae). *Taxon*, 46: 15-19.
- MURASHIGE T., SKOOG F. (1962). A revised medium for rapid growth and bioassays with tobacco tissue culture. *Physiologia Plantarum*, 15: 473-487.
- OKUBO H. (1993). *Hippeastrum* (Amaryllis). In: De Hertogh A., Le Nard M. (Eds). *The Physiology of Flower Bulbs*. Elsevier, Amsterdam - London - New York - Tokyo: 321-333.
- PACHOLCZAK A., NOWAKOWSKA K. (2017). Effect of the biopreparation “Goteo” on rooting of hydrangea stem cuttings (*Hydrangea paniculata* Siebold ‘Limelight’ and Vanille Freise® ‘Renhy’). *Propagation of Ornamental Plants*, 17: 126-133.
- PACHOLCZAK A., NOWAKOWSKA K., MIKA N., BORKOWSKA M. (2016). The effect of the biostimulator Goteo on rooting of ninebark stem cuttings. *Folia Horticulturae*, 28: 109-116.
- PIERIK R. L. M., BLOKKER J. S., DEKKER M. W. C., DE DOES H., KUIP A. C., VAN DER MADE T. A., MENTEN Y. M. J., DE VETTEN N. C. M. H. (1990). Micropropagation of hippeastrum hybrids. In: J. de Jong (Ed.). *Integration of in vitro techniques in ornamental plant breeding*. Proceedings of a Symposium, EUCARPIA, Section Ornamentals, 10-14 November 1990, Wageningen, The Netherlands: 21-27.
- PODWYSZYŃSKA M. (2012). The mechanism of *in vitro* storage organ formation in ornamental geophytes. In: van Tuyl J., Arens P. (Eds). *Floriculture and Ornamental Biotechnology*, Global Science Book, 6 (Special Issue 2): 9-23.
- REES A. R. (1972). Bulb structure, morphology, development and periodicity. In: Rees A. R. (Ed.). *The Growth of Bulbs: Applied Aspects of the Physiology of Ornamental Bulbous Crop Plant*. Academic Press, London - New York: 17-44.

- SALACHNA P., ZAWADZIŃSKA A., PIECHOCKI R., WILAS J. (2014). Propagation of Arabian star flower (*Ornithogalum arabicum* L.) by twin scales using seaweed extracts. *Folia Pomeranae Universitatis Technologiae Stetinensis, Agricultura, Alimentaria, Piscaria et Zootechnica*, 310: 105-112 (in Polish).
- SEABROOK J. E. A., CUMMING B. G. (1977). The *in vitro* propagation of amaryllis (*Hippeastrum* spp. hybrids). *In Vitro*, 13: 831-836.
- SIDDIQUE M. N. A., SULTANA J., SULTANA N., HOSSAIN M. M. (2007). *Ex vitro* establishment of *in vitro* produced plantlets and bulblets of *Hippeastrum* (*Hippeastrum hybridum*). *International Journal of Sustainable Crop Production*, 2: 22-24.
- SMITH R. H., BURROWS J., KURTEN K. (1999). Challenges associated with micropropagation of *Zephyranthes* and *Hippeastrum* sp. (*Amaryllidaceae*). *In Vitro Cellular & Developmental Biology - Plant*, 35: 281-282.
- SULTANA J., SULTANA N., SIDDIQUE M. N. A., ISLAM A. K. M. A., HOSSAIN M. M., HOSSAIN T. (2010). *In vitro* bulb production in *Hippeastrum* (*Hippeastrum hybridum*). *Journal of Central European Agriculture*, 11: 469-474.
- SWART P. A., KULKARNI M. G., BAIRU M. W., FINNIE J. F., VAN STADEN J. (2012). Micropropagation of *Romulea sabulosa* Schltr. ex Beg. - a potential ornamental plant. *Scientia Horticulturae*, 135: 151-156.
- TAEB A. G., ALDERSON P. G. (1990). Effect of low temperature and sucrose on bulb development and on the carbohydrate status of bulbing shoots of tulip *in vitro*. *Journal of Horticultural Science*, 65: 193-197.
- VIJVERBERG A. J. (1981). Growing Amaryllis. Grower Guide no. 23, Grower Books, London, 57 pp.
- WALLY O. S. D., CRITCHLEY A. T., HILTZ D., CRAIGIE J. S., HAN X., ZAHARIA L. I., ABRAMS S. R., PRITHIVIRAJ B. (2013). Regulation of phytohormone biosynthesis and accumulation in *Arabidopsis* following treatment with commercial extract from the marine macroalga *Ascophyllum nodosum*. *Journal of Plant Growth Regulators*, 32: 324-341.
- WITOMSKA M. (2002). Effect of sucrose concentration, BAP and NAA on regeneration *in vitro* of *Hippeastrum* × *chmielii* Chm. *Annals of Warsaw Agricultural University – SGGW, Horticulture and Landscape Architecture*, 23: 17-22.
- WITOMSKA M., ILCZUK A. (2004). Formation of adventitious bulblets *in vitro* on scale explants in *Hippeastrum* × *chmielii* Chm. *Biotechnologia*, 2: 199-205 (in Polish).
- WITOMSKA M., LATKOWSKA M. (2005). Efficacy of *in vitro* propagation of *Hippeastrum* × *chmielii* Chm. from shoot and scale explants. *Zeszyty Problemowe Postępów Nauk Rolniczych*, 504: 335-341 (in Polish).
- WITOMSKA M., ŁUKASZEWSKA A., WOJCIWICZ M. (2007). Effect of medium type, benzyladenine and sucrose on micropropagation of *Hippeastrum* × *chmieli* Chm. *Annals of Warsaw Agricultural University – SGGW, Horticulture and Landscape Architecture*, 28: 71-78.
- WITOMSKA M., ŁUKASZEWSKA A., WOJCIWICZ M. (2008). Micropropagation of *Hippeastrum* × *chmieli* Chm. from scale and scape explants. *Propagation of Ornamental Plants*, 8: 158-160.
- WITOMSKA M., NOSARZEWSKA R. (2001). Effect of light quality and growth regulators on regeneration of *Hippeastrum* × *chmielii* Chm. *in vitro*. *Roczniki Akademii Rolniczej w Poznaniu – CCCXXXII, Ogrodnictwo*, 33: 151-156 (in Polish).
- YANAGAWA T., OSAKI T. (1996). *In vitro* propagation of bulblets and elimination of viruses by bulb-scale cultures of *Hippeastrum hybridum* bulbs. *Plant Tissue Culture Letters*, 13: 147-152.
- ZAKIZADEH S., KAVANI B., ONSINEJAD R. (2013). *In vitro* rooting of amaryllis (*Hippeastrum johnsonii*), a bulbous plant, via NAA and 2-iP. *Annals of Biological Research*, 4: 69-71.
- ZAYED R., EL-SHAMY H., BERKOV S., BATISTA J., CODINA C. (2011). *In vitro* micropropagation and alkaloids of *Hippeastrum vittatum*. *In Vitro Cellular & Developmental Biology - Plant*, 47: 695-701.