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REFERENCES

Abraham, T., Mathew, J., Srivinas, P., & Jacob, C. K. (2005). Incidence of tapping panel dryness (TPD) on popular rubber clones in southern rubber growing region of India. *International Workshop on Tapping Panel Dryness, 10 November 2005*, 1–16. https://doi.org/10.13140/2.1.4413.2166

Adou, B. Y. C., Okoma, K. M., Obouayeba, A. P., Atsin, G. J. O., Ballo, E. K., Essehi, J. L., Wahounou, P. J., Soumahin, E. F., Kouakou Tanoh, H., & Obouayeba, S. (2018a). Latex micro diagnosis, modern management tool of rubber plantations of clones with active or rapid metabolism IRCA 18, IRCA 130, PB 235, PB 260 and PB 330. *European Scientific Journal*, *14*(3), 384–407. https://doi.org/10.19044/esj.2018.v14n3p385

Adou, B. Y. C., Okoma, K. M., Obouayeba, A. P., Atsin, G. J. O., Ballo, E. K., Essehi, J. L., Wahounou, P. J., Soumahin, E. F., Kouakou Tanoh, H., & Obouayeba, S. (2018b). Contribution of latex micro diagnosis to modern management of rubber plantations: case of clones with low or slow metabolism PB 217 and PR 107. *European Scientific Journal*, *14*(9), 312–329. https://doi.org/10.19044/esj.2018.v14n9p312

Adou, C. Y. B., Atsin, O. J. G., Essehi, J. L., Ballo, K. E., Soumahin, F. E., Obouayeba, P. A., Kouakou, H. T., & Obouayeba, S. (2017). Latex micro diagnosis, modern management tool of rubber plantations of clones with moderate metabolism GT 1, RRIC 100 and BPM 24. *Journal of Applied Biosciences*, *121*(1), 12098–12109. https://doi.org/10.4314/jab.v121i1.1

Aji, M., Supijatno, & Santosa, E. (2021). Produksi klon IRR 112 pada sistem sadap yang berbeda. *Jurnal Penelitian Karet*, *39*(1), 11–20. https://doi.org/10.22302/ppk.jpk.v39i1.766

Ajith, S. V., Nair, N. N., Sathik, M. B. M., & Meenakumari, T. (2021). Breeding for low-temperature stress tolerance in *Hevea brasiliensis*: screening of newly developed clones using latex biochemical parameters. *Journal of Rubber Research*, *24*(5), 819–828. https://doi.org/10.1007/s42464-021-00143-2

Alam, B., Das, G., Raj, S., Roy, S., Pal, T. K., & Dey, S. K. (2003). Studies on yield and biochemical sub-components of latex of rubber trees (*Hevea brasiliensis*) with a special reference to the impact of low temperature in a non-optimal environment. *Journal of Rubber Research*, *6*(4), 241.

Alscher, R. G. (1989). Biosynthesis and antioxidant function of glutathione in plants. *Physiologia Plantarum*, *77*(3), 457–464. https://doi.org/10.1111/j.1399-3054.1989.tb05667.x

Ambily, P. K., Tomas, M., Sreelatha, S., Krishnakumar, R., Annamalainathan, K., & Jacob, J. (2018). Expression analysis of rubber biosynthesis pathway genes in *Hevea brasiliensis*. *Journal of Plantation Crops*, *46*(2), 102–111. https://doi.org/10.25081/jpc.2018.v46.12.3721

Amerik, A. Y., Martirosyan, Y. T., & Gachok, I. V. (2018). Regulation of natural rubber biosynthesis by proteins associated with rubber particles. *Russian Journal*

UNIVERSITAS GADJAH MADA
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of Bioorganic Chemistry, *44*(2), 140–149. https://doi.org/10.1134/S106816201801003X

An, F., Cahill, D., Rookes, J., Lin, W., & Kong, L. (2014). Real-time measurement of phloem turgor pressure in *Hevea brasiliensis* with a modified cell pressure probe. *Botanical Studies*, *55*(1), 1–11. https://doi.org/10.1186/1999-3110-55-19

An, F., Cai, X., Rookes, J., Xie, G., Zou, Z., Cahill, D., & Kong, L. X. (2015). Latex dilution reaction during the tapping flow course of *Hevea brasiliensis* and the effect of Ethrel stimulation. *Brazilian Journal of Botany*, *38*(2), 211–221. https://doi.org/10.1007/s40415-014-0125-7

An, F., Zou, Z., Cai, X., Wang, J., Rookes, J., Lin, W., Cahill, D., & Kong, L. (2015). Regulation of *HbPIP2;3*, a latex-abundant water transporter, is associated with latex dilution and yield in the rubber tree (*Hevea brasiliensis* Muell. Arg.). *PLoS ONE*, *10*(4), e0125595. https://doi.org/10.1371/journal.pone.0125595

An, Z., Zhao, Y., Zhang, X., Huang, X., Hu, Y., Cheng, H., Li, X., & Huang, H. (2019). A high-density genetic map and QTL mapping on growth and latex yield-related traits in *Hevea brasiliensis* Müll.Arg. *Industrial Crops and Products*, *132*, 440–448. https://doi.org/10.1016/j.indcrop.2019.03.002

Atminingsih, Tistama, R., Junaidi, & Saban, I. (2019). The effect of high stimulant concentration on the yield and dry rubber content of high metabolic clone RRIM 911 in low-tapping frequency practice. *AGRIUM: Jurnal Ilmu Pertanian*, *22*(1), 11–17. https://doi.org/10.30596/agrium.v21i3.2456

Attanayake, A. P., Karunanayake, L., & Nilmini, A. H. R. L. (2018). Effect of ethephon stimulation on natural rubber latex properties; new insight into ethephon stimulation. *Journal of the National Science Foundation of Sri Lanka*, *46*(2), 179. https://doi.org/10.4038/jnsfsr.v46i2.8418

Baker, C. S. L. (1996). Natural rubber – ab initio ad futurum. *Rubber Developments*, *49*, 40–44.

Borisova, G., Chukina, N., Maleva, M., Kumar, A., & Prasad, M. N. V. (2016). Thiols as biomarkers of heavy metal tolerance in the aquatic macrophytes of Middle Urals, Russia. *International Journal of Phytoremediation*, *18*(10), 1037–1045. https://doi.org/10.1080/15226514.2016.1183572

Bottier, C. (2020). Biochemical composition of *Hevea brasiliensis* latex: A focus on the protein, lipid, carbohydrate and mineral contents. In R. Nawrot (Ed.), *Latex, Laticifers and Their Molecular Components: From Functions to Possible Applications* (Issue 93, pp. 201–237). Academic Press. https://doi.org/10.1016/bs.abr.2019.11.003

Broekaert, I., Lee, H. I., Kush, A., Chua, N. H., & Raikhel, N. (1990). Wound-induced accumulation of mRNA containing a hevein sequence in laticifers of rubber tree (*Hevea brasiliensis*). *Proceeding of National Academic Sciences of USA*, *87*(19), 7633–7637. https://doi.org/10.1073/pnas.87.19.7633

Bulley, S., & Laing, W. (2016). The regulation of ascorbate biosynthesis. *Current Opinion in Plant Biology*, *33*, 15–22. https://doi.org/10.1016/j.pbi.2016.04.010

Cardoso, S. E. A., Freitas, T. A., Silva, D. D. C., Gouvêa, L. R. L., Gonçalves, P. D.

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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

S., Mattos, C. R. R., & Garcia, D. (2014). Comparison of growth, yield and related traits of resistant *Hevea* genotypes under high South American leaf blight pressure. *Industrial Crops and Products*, *53*, 337–349. https://doi.org/10.1016/j.indcrop.2013.12.033

Carvalho, P. A. de, Oliveira, L. E. M. de, Domiciano, D., Carvalho, J. N. de, Prudente, D. O. de O., Guimarães, R. J., de Carvalho, P. A., de Oliveira, L. E. M., Domiciano, D., de Carvalho, J. N., Prudente, D. O. de O., & Guimarães, R. J. (2018). Effect of nitrogen source and oxygen deficiency on carbon metabolism and antioxidant system of rubber tree plants (*Hevea* spp.). *Australian Journal of Crop Science*, *12*(1), 116–125. https://doi.org/10.21475/ajcs.18.12.01.pne774

Cassia, R., Nocioni, M., Correa-Aragunde, N., & Lamattina, L. (2018). Climate change and the impact of greenhouse gasses: CO2 and NO, friends and foes of plant oxidative stress. *Frontiers in Plant Science*, *9*(March), 1–11. https://doi.org/10.3389/fpls.2018.00273

Castelblanque, L., Balaguer, B., Martí, C., Rodríguez, J. J., Orozco, M., & Vera, P. (2017). Multiple facets of laticifer cells. *Plant Signaling & Behavior*, *12*(7), e1300743. https://doi.org/10.1080/15592324.2017.1300743

Castro, A. R. de M., Sanjad, N., & Romeiro, D. dos S. (2009). From rubber tree homeland to rubber tree plantation: Jacques Huber and his studies on the culture of heveas in the East (1911-1912). *Boletimdo Museu Paraense*, *4*(3), 503–545. https://doi.org/10.1590/S1981-81222009000300011

Chaendaekattu, N., & Mydin, K. K. (2014). Inheritance of tapping panel dryness in full-sib population of *Hevea brasiliensis*. *Rubber Science*, *27*(1), 78–83.

Chandra, K., & Pandey, A. (2017). QTL mapping in crop improvement: a basic concept. *International Journal of Current Microbiology and Applied Sciences*, *6*(12), 835–842. https://doi.org/10.20546/ijcmas.2017.612.089

Chantuma, P., Lacote, R., Leconte, A., & Gohet, E. (2011). An innovative tapping system, the double cut alternative, to improve the yield of *Hevea brasiliensis* in Thai rubber plantations. *Field Crops Research*, *121*(3), 416–422. https://doi.org/10.1016/j.fcr.2011.01.013

Chao, J., Zhang, S., Chen, Y., & Tian, W.-M. (2015). Cloning, heterologous expression and characterization of ascorbate peroxidase (APX) gene in laticifer cells of rubber tree (*Hevea brasiliensis* Muell. Arg.). *Plant Physiology and Biochemistry*, *97*, 331–338. https://doi.org/10.1016/j.plaphy.2015.10.023

Chen, J. W., Bai, K. D., & Cao, K. F. (2009). Inhibition of monoterpene biosynthesis accelerates oxidative stress and leads to enhancement of antioxidant defenses in leaves of rubber tree (*Hevea brasiliensis*). *Acta Physiologiae Plantarum*, *31*(1), 95–101. https://doi.org/10.1007/s11738-008-0205-z

Chen, J. W., & Cao, K. F. (2008). Changes in activities of antioxidative system and monoterpene and photochemical efficiency during seasonal leaf senescence in *Hevea brasiliensis* trees. *Acta Physiologiae Plantarum*, *30*(1), 1–9. https://doi.org/10.1007/s11738-007-0070-1

Chen, Q., Chen, X., Wang, J., & Lin, W. (2020). Effects of ethephon stimulation and

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

cut length by vertically tapping on rubber yield and latex quality. *International Journal of Horticulture, Agriculture and Food Science*, *4*(4), 132–138. https://doi.org/10.22161/ijhaf.4.4.1

Chen, S., Peng, S., Huang, G., Wu, K., Fu, X., & Chen, Z. (2002). Association of decreased expression of a Myb transcription factor with the TPD (tapping panel dryness) syndrome in *Hevea brasiliensis*. *Plant Molecular Biology*, *51*, 51–58. https://doi.org/10.1023/A:1020719420867

Chow, K. S., Mat-Isa, M. N., Bahari, A., Ghazali, A. K., Alias, H., Mohd.-Zainuddin, Z., Hoh, C. C., & Wan, K. L. (2012). Metabolic routes affecting rubber biosynthesis in *Hevea brasiliensis* latex. *Journal of Experimental Botany*, *63*(5), 1863–1871. https://doi.org/10.1093/jxb/err363

Chrestin, H., Bangratz, J., d'Auzac, J., & Jacob, J. L. (1984). Role of the lutoidic tonoplast in the senescence and degeneration of the laticifers of *Hevea brasiliensis*. *Zeitschrift Für Pflanzenphysiologie*, *114*(3), 261–268. https://doi.org/10.1016/s0044-328x(84)80020-3

Chrestin, Herve. (1985). *La Vacuole dans l'Homéostasie et la Sénescence des Cellules Laticifères d'*Hevea. Universite Montpellier II, Montpellier, France.

Conson, A. R. O., Taniguti, C. H., Amadeu, R. R., Andreotti, I. A. A., de Souza, L. M., dos Santos, L. H. B., Rosa, J. R. B. F., Mantello, C. C., da Silva, C. C., José Scaloppi Junior, E., Ribeiro, R. V., Le Guen, V., Garcia, A. A. F., Gonçalves, P. de S., & de Souza, A. P. (2018). High-resolution genetic map and QTL analysis of growth-related traits of *Hevea brasiliensis* cultivated under suboptimal temperature and humidity conditions. *Frontiers in Plant Science*, *9*, 1–16. https://doi.org/10.3389/fpls.2018.01255

Coupe, M., & Chrestin, H. (1989). Physio-chemical and biochemical mechanism of hormonal (ethylene) stimulation. In J d'Auzac, J. L. Jacob, & H. Chrestin (Eds.), *Physiology of Rubber Tree Latex* (pp. 295–320). CRC Press Inc.

d'Auzac, J, Cretin, H., Marin, B., & Lioret, C. (1982). A plant vacuolar system: the lutoids from *Hevea brasiliensis* latex. *Physiologie Vegetale*, *20*(2), 311–331.

d'Auzac, J, Jacob, J.-L., & Chrestin, H. (Eds.). (1989). *Physiology of Rubber Tree Latex*. CRC Press Inc.

d'Auzac, Jean, & Jacob, J.-L. (1989). The composition of latex from *Hevea brasiliensis* as a laticiferous cytoplasm. In Jean d'Auzac, J.-L. Jacob, & H. Chrestin (Eds.), *Physiology of Rubber Tree Latex* (pp. 59–96). CRC Press Inc.

da Cruz, A. T., Pereira, J. C. da S., & Mendonca, S. R. (2017). Stimulation of latex production in Seringueira (*Hevea brasiliensis*) with Ethrel doses. *Revista Árvore*, *41*(5), e410511. https://doi.org/10.1590/1806-90882017000500011

Dar, M. I., Naikoo, M. I., Khan, F. A., Rehman, F., Green, I. D., Naushin, F., & Ansari, A. A. (2017). An introduction to reactive oxygen species metabolism under changing climate in plants. In M. I. R. Khan & N. A. Khan (Eds.), *Reactive Oxygen Species and Antioxidant Systems in Plants: Role and Regulation under Abiotic Stress* (p. 328). Springer Nature. https://doi.org/10.1007/978-981-10-5254-5

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Darojat, M. R., & Sayurandi. (2018). Status klon-klon karet seri IRR hasil kegiatan pemuliaan Indonesia dan adopsinya di perkebunan karet Indonesia. *Perspektif*, *17*(2), 150–165. https://doi.org/10.21082/psp.v17n2.2018

Das, K., & Roychoudhury, A. (2014). Reactive oxygen species (ROS) and response of antioxidants as ROS-scavengers during environmental stress in plants. *Frontiers in Environmental Science*, *2*(article 53), 1–13. https://doi.org/10.3389/fenvs.2014.00053

de Fay, E, Sanier, C., & Hebant, C. (1989). The distribution of plasmodesmata in the phloem of *Hevea brasiliensis* in relation to laticifer loading. *Protoplasma*, *149*, 155–162.

de Fay, Elisabeth. (2011). Histo- and cytopathology of trunk phloem necrosis, a form of rubber tree (*Hevea brasiliensis* Müll. Arg.) tapping panel dryness. *Australian Journal of Botany*, *59*(6), 563. https://doi.org/10.1071/BT11070

de Fay, Elisabeth, Moraes, L. A. C., & Moraes, V. H. de F. (2010). Cyanogenesis and the onset of tapping panel dryness in rubber tree. *Pesquisa Agropecuária Brasileira*, *45*(12), 1372–1380. https://doi.org/10.1590/s0100-204x2010001200006

de Jonge, P., & Westgarth, D. R. (1962). The effect of size of tapping task on the yield. *Journal of Rubber Research Institute of Malaya*, *17*(4), 150–158.

Deka, H. K., Mathew, J., Abraham, T., & Jacob, C. K. (2006). Characterisation of TPD in different clones of *Hevea* in CUT panel. In J. Jacob, R. Krishnakumar, & N. M. Mathew (Eds.), *Tapping Panel Dryness of Rubber Trees* (p. 296). Rubber Research Institute of India.

Deng, Z., Zhao, M., Liu, H., Wang, Y., & Li, D. (2015). Molecular cloning, expression profiles and characterization of a glutathione reductase in *Hevea brasiliensis*. *Plant Physiology and Biochemistry*, *96*, 53–63. https://doi.org/10.1016/j.plaphy.2015.07.022

Dian, K., Okoma, M. K., Gnagne, M. Y., Gabla, R. O., & Obouayeba, S. (2016). Impact of intensive stimulation with ethephon in downward tapping on the potential of production in upward tapping in GT 1 clone of *Hevea brasiliensis*. *International Journal of Current Science*, *19*(3), E 11-23.

Dian, K., Okoma, M. K., Koffi, E. K., Pokou, N. D., Kan, M. K., Kouadjo, G. Z., Kouassi1, N. K., Sangare, A., & Obouayeba, S. (2016). Effect of ethephon stimulation frequency in downward tapping on the production potential in upward tapping among PB 260 clone of *Hevea brasiliensis* in Ivory Coast. *International Journal of Agronomy and Agricultural Research*, *8*(2), 51–63.

Dian, K., Yedoh Gnagne, M., Okoma, M. K., & Sagare, A. (2017). Effect of ethephon stimulation on downward tapping in latex production metabolism on upward tapping in PB 217 clone of *Hevea brasiliensis*. *International Journal of Environment, Agriculture and Biotechnology*, *2*(6), 2944–2957. https://doi.org/10.22161/ijeab/2.6.22

Diarrassouba, M., Sanogo, S., Camara, B., & Obouayeba, S. (2021). Latex harvesting technologies adapted to *Hevea brasiliensis* Muell Arg. clones GT 1; RRIC 100

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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and BPM 24 (Euphorbiaceae) belonging to the moderate metabolism class in the socio-economic context of Côte d'Ivoire. *European Journal of Biology and Biotechnology*, *2*(6), 10–19. https://doi.org/10.24018/ejbio.2021.2.6.301

Dickenson, P. B. (1969). Electron microscopical studies of latex vessel system of *Hevea brasiliensis*. *Journal of Rubber Research Institute of Malaya*, *21*(4), 543–559.

Dische, Z. M. (1962). Carbohydrate chemistry. In R. L. Whistler & M. L. Wolfrom (Eds.), *Methods in Carbohydrate Chemistry* (pp. 475–514). Academic Press.

Ditjenbun. (2020). *Statistik Perkebunan Unggulan Nasional 2019-2021* (D. Gartina & R. L. L. Sukriya (Eds.)). Direktorat Jendral Perkebunan Kementerian Pertanian Republik Indonesia.

Duan, C., Rio, M., Leclercq, J., Bonnot, F., Oliver, G., & Montoro, P. (2010). Gene expression pattern in response to wounding, methyl jasmonate and ethylene in the bark of *Hevea brasiliensis*. *Tree Physiology*, *30*(10), 1349–1359. https://doi.org/10.1093/treephys/tpq066

Dunphy, P. J., Whittle, K. J., Pennock, J. F., & Morton, R. A. (1965). Identification and estimation of tocotrienol in *Hevea* latex. *Nature*, *207*(4996), 521–522.

Encyclopaedia Britannica. (2019). *American Inventor: Charles Goodyear*. Encyclopaedia Britannica.

Fatima, A., Singh, A. A., Mukherjee, A., & Agrawal, M. (2019). Ascorbic acid and thiols as potential biomarkers of ozone tolerance in tropical wheat cultivars. *Ecotoxicology and Environmental Safety*, *171*, 701–708. https://doi.org/10.1016/j.ecoenv.2019.01.030

Fipriani, A., Rosmayati, Tistama, R., & Damanik, R. I. M. (2019). Physiological respon of TPD-affected rubber plant to growth regulator and antioxidant treatments. *Proceedings of the International Conference on Natural Resources and Technology*, 270–274. https://doi.org/10.5220/0008553002700274

Foyer, C. H., & Halliwell, B. (1976). The presence of glutathione and glutathione reductase in chloroplasts: a proposed role in ascorbic acid metabolism. *Planta*, *133*, 21–25.

Foyer, C. H., & Noctor, G. (2011). Ascorbate and glutathione: the heart of the redox hub. *Plant Physiology*, *155*, 2–18. https://doi.org/10.1104/pp.110.167569

Gohet, E., Cauchy, T., Soumahoro, M., Kotochi, C., Chegbene, P., Njoku, A., & Lesturgez, G. (2019). Meta-analysis of a large industrial latex diagnosis database provides insight on *Hevea brasiliensis* clonal adaptation and site-specific yield potential in Western Africa. *Proceeding of IRRDB Rubber Conference*, 1–19.

Golbon, R., Cotter, M., & Sauerborn, J. (2018). Climate change impact assessment on the potential rubber cultivating area in the Greater Mekong Subregion. *Environmental Research Letters*, *13*(8), 084002. https://doi.org/10.1088/1748-9326/aad1d1

Gracz-Bernaciak, J., Mazur, O., & Nawrot, R. (2021). Functional studies of plant latex as a rich source of bioactive compounds: focus on proteins and alkaloids. *International Journal of Molecular Sciences*, *22*(22), 12427.

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

https://doi.org/10.3390/ijms222212427

Guo, X. L., Sun, L., Hu, Y. Y., Liu, J. P., Wang, Z. H., & Yuan, K. (2016). Analysis on latex physiological parameters of *Hevea brasiliensis* plants at different tapping panel dryness extents. *Journal of Southern Agriculture*, *47*(9), 1553–1557.

Hale, A. L., Reddivari, L., Nzaramba, M. N., Bamberg, J. B., & Miller, J. C. (2008). Interspecific variability for antioxidant activity and phenolic content among *Solanum* species. *American Journal of Potato Research*, *85*(5), 332–341. https://doi.org/10.1007/s12230-008-9035-1

Hanen, F., Riadh, K., Samia, O., Sylvain, G., Christian, M., & Chedly, A. (2009). Interspecific variability of antioxidant activities and phenolic composition in *Mesembryanthemum* genus. *Food and Chemical Toxicology*, *47*(9), 2308–2313. https://doi.org/10.1016/j.fct.2009.06.025

Hao, B. Z., & Wu, J. L. (2000). Laticifer differentiation in *Hevea brasiliensis*: induction by exogenous jasmonic acid and linolenic acid. *Annals of Botany*, *85*(1), 37–43. https://doi.org/10.1006/anbo.1999.0995

Hasanuzzaman, M., Nahar, K., Anee, T. I., & Fujita, M. (2017). Glutathione in plants: biosynthesis and physiological role in environmental stress tolerance. *Physiology and Molecular Biology of Plants*, *23*(2), 249–268. https://doi.org/10.1007/s12298-017-0422-2

Herlinawati, E., Aji, M., Cahyo, A. N., Ismawanto, S., & Kuswanhadi. (2016). Effect of different seasons on the production, latex physiological parameters, soil water content and the pattern of leaves shed of IRR series clones. *Proceeding of CRRI & IRRDB International Rubber Conference 2016, Siem Reap, Cambodia*, 205–212.

Herlinawati, E., & Kuswanhadi. (2012). Pengaruh penggunaan stimulan gas terhadap produksi dan karakter fisiologi klon BPM 24. *Jurnal Penelitian Karet*, *30*(2), 100–107. https://doi.org/10.22302/jpk.v30i2.126

Hiremath, S. R., & Prathapan, K. D. (2019). First report of the invasive South American Pinhole Borer, *Euplatypus paralellus* (Fabricius) (Coleoptera: Curculionidae: Platypodinae) on rubber in India. *The Coleopterists Bulletin*, *73*(3), 714–717. https://doi.org/10.1649/0010-065X-73.3.714

Hodges, D. M., & Forney, C. F. (2000). The effects of ethylene, depressed oxygen and elevated carbon dioxide on antioxidant profiles of senescing spinach leaves. *Journal of Experimental Botany*, *51*(344), 645–655. https://doi.org/10.1093/jexbot/51.344.645

Hou, B., Li, W., Gao, X., Zhang, X., Feng, S., & Wu, Y. (2021). Construction and integration of genetic map and quantitative trait locus (QTL) mapping of yield-related traits. *Acta Agriculturae Scandinavica Section B: Soil and Plant Science*, *71*(7), 560–574. https://doi.org/10.1080/09064710.2021.1884743

Hussain, N., Irshad, F., Jabeen, Z., Shamsi, I. H., Li, Z., & Jiang, L. (2013). Biosynthesis, structural, and functional attributes of tocopherols in planta; past, present, and future perspectives. *Journal of Agricultural and Food Chemistry*,

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

61(26), 6137–6149. https://doi.org/10.1021/jf4010302

Irénée, L. M., Djezou, K., Mathurin, O. K., Naté, Y. A., Séraphin, K. K., Michel, Z., & Samuel, O. (2020). Effect of exogenous hormonal stimulation on the metabolic partition between plant growth and rubber production of *Hevea brasiliensis* clones according to the class of metabolic activity in Cote d'Ivoire. *Asian Research Journal of Agriculture*, *13*(4), 46–64. https://doi.org/10.9734/ARJA/2020/v13i430112

Jacob, J. L., d'Auzac, J., & Prevôt, J. C. (1993). The composition of natural latex from *Hevea brasiliensis*. *Clinical Reviews in Allergy*, *11*(3), 325–337.

Jacob, J. L., Prévôt, J. C., Chrestin, H., & Anne-Clement, V. (1984). Glutathione reductase and thiols in latex: their role in *Hevea* yield. *Proceedings of the Symposium "Exploitation, Physiology and Improvement of Hevea,"* 101–114.

Jacob, J. L., Prévôt, J. C., Lacrotte, R., & Eschbach, J. M. (1995). Latex diagnosis. *Plantations, Recherche, Developpement*, *2*(2), 33–37.

Jacob, J. L., Prévôt, J. C., Roussel, D., Lacrotte, R., Serres, E., D'Auzac, J., Eschbach, J. M., & Omont, H. (1989). Yield limiting factors, latex physiological parameters, latex diagnosis, and clonal typology. In Jean d'Auzac, J. L. Jacob, & H. Chrestin (Eds.), *Physiology of Rubber Tree Latex* (pp. 345–382). CRC Press.

Jones, K. P., & Allen, P. W. (1992). Historical development of the world rubber industry. In M. R. Sethuraj & N. M. Mathew (Eds.), *Natural Rubber: Biology, Cultivation and Technology* (pp. 1–25). Elsevier Science Publisher B.V.

Junaidi, Atminingsih, & Darojat, M. R. (2019). Direction, panel height, and tapping frequency affect the daily bark consumption in *Hevea* rubber tapping. *Planta Tropika*, *7*(1), 58–65. https://doi.org/10.18196/pt.2019.094.58-65

Klaewklad, A., Nakkanong, K., Nathaworn, C. D., & Nualsri, C. (2016). Expression of rubber elongation factor (REF) and small rubber particle protein (SRPP) relates to dry rubber yield of clonal varieties. *Pakistan Journal of Biotechnology*, *13*(1), 19–29.

Konno, K. (2011). Plant latex and other exudates as plant defense systems: roles of various defense chemicals and proteins contained therein. *Phytochemistry*, *72*(13), 1510–1530. https://doi.org/10.1016/j.phytochem.2011.02.016

Krishnakumar, R., Ambily, P. K., & Jacob, J. (2014). Plant hormones and oxidative stress in *Hevea brasiliensis*. *Journal of Plantation Crops*, *42*(1), 86–93.

Krishnakumar, R., Helen, R. L., Ambily, P. K., & Jacob, J. (2011). A modified stimulation method in *Hevea brasiliensis* for reducing oxidative stress. *International Rubber Conference*, 1–10.

Krishnan, A., Joseph, L., & Roy, C. B. (2019). An insight into *Hevea* - *Phytophthora* interaction: The story of *Hevea* defense and *Phytophthora* counter defense mediated through molecular signalling. *Current Plant Biology*, *17*, 33–41. https://doi.org/10.1016/j.cpb.2018.11.009

Kudaligama, K. V. V. S., Lakshman, R. G. N., & Rodrigo, V. H. L. (2017). Performance of once in three days (S/2 d3) and four days (S/2 d4) tapping systems in marginal drier areas in Sri Lanka. *International Rubber Conference*

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

2017, 401–412.

Kumar, A., Pandey, D. M., Abraham, T., Mathew, J., Ramachandran, P., & Malathi, V. G. (2013). Determination of biotic aetiology of tapping panel dryness (TPD) syndrome of rubber tree (*Hevea brasiliensis*) by return-polyacrylamide gel electrophoresis (R-PAGE) technique. *Archives of Phytopathology and Plant Protection*, *46*(6), 710–720. https://doi.org/10.1080/03235408.2012.750814

Lacote, R., Gabla, O., Obouayeba, S., Eschbach, J. M., Rivano, F., Dian, K., & Gohet, E. (2010). Long-term effect of ethylene stimulation on the yield of rubber trees is linked to latex cell biochemistry. *Field Crops Research*, *115*(1), 94–98. https://doi.org/10.1016/j.fcr.2009.10.007

Lacrotte, R., Jacob, J. L., Chrestin, H., Pujade-Renaud, V., & Montoro, P. (1997). Biochemical and histological aspects of necrotic and induced tapping pannel dryness (TPD). *Seminar on the Biochemical and Molecular Tools for Exploitation Diagnostic and Rubber Tree Improvement*, IV-1-IV–17.

Lewinsohn, T. M. (1991). The geographical distribution of plant latex. *Chemoecology*, *2*(1), 64–68. https://doi.org/10.1007/BF01240668

Li, D., Deng, Z., Chen, C., Xia, Z., Wu, M., He, P., & Chen, S. (2010). Identification and characterization of genes associated with tapping panel dryness from *Hevea brasiliensis* latex using suppression subtractive hybridization. *BMC Plant Biol*, *10*(1), 140. https://doi.org/10.1186/1471-2229-10-140

Li, D., Wang, X., Deng, Z., Liu, H., Yang, H., & He, G. (2016). Transcriptome analyses reveal molecular mechanism underlying tapping panel dryness of rubber tree (*Hevea brasiliensis*). *Scientific Reports*, *6*(5), 1–10. https://doi.org/10.1038/srep23540

Li, Z., Wang, H., Zhao, R., Zhang, Z., Xia, Z., Zhai, J., & Huang, X. (2020). Complete genome sequence of a novel capillovirus infecting *Hevea brasiliensis* in China. *Archives of Virology*, *165*(1), 249–252. https://doi.org/10.1007/s00705-019-04459-8

Lieberei, R. (2007). South American Leaf Blight of the rubber tree (*Hevea* spp.): new steps in plant domestication using physiological features and molecular markers. *Annals of Botany*, *100*(6), 1125–1142. https://doi.org/10.1093/aob/mcm133

Liu, H., Wei, Y., Deng, Z., Yang, H., Dai, L., & Li, D. (2019). Involvement of HbMC1-mediated cell death in tapping panel dryness of rubber tree (*Hevea brasiliensis*). *Tree Physiology*, *39*(3), 391–403. https://doi.org/10.1093/treephys/tpy125

Liu, J. P. P., Zhuang, Y. F. F., Guo, X. L. L., & Li, Y. J. J. (2016). Molecular mechanism of ethylene stimulation of latex yield in rubber tree (*Hevea brasiliensis*) revealed by *de novo* sequencing and transcriptome analysis. *BMC Genomics*, *17*(1), 257. https://doi.org/10.1186/s12864-016-2587-4

Liu, J. P., Xia, Z. Q., Tian, X. Y., & Li, Y. J. (2015). Transcriptome sequencing and analysis of rubber tree (*Hevea brasiliensis* Muell.) to discover putative genes associated with tapping panel dryness (TPD). *BMC Genomics*, *16*(398), 398. https://doi.org/10.1186/s12864-015-1562-9

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Lubis, A. F., Rosmayanti, Tistama, R., & Damanik, R. I. M. (2021). Activities of ascorbic peroxidase (Apx) and tannin clones PB 260 on tapping panel dryness (TPD). *International Journal of Multi Science*, *1*(12), 54–60.

Mageney, V., Baldermann, S., & Albach, D. C. (2016). Intraspecific variation in carotenoids of *Brassica oleracea* var. *sabellica*. *Journal of Agricultural and Food Chemistry*, *64*(16), 3251–3257. https://doi.org/10.1021/acs.jafc.6b00268

Mai, J., Herbette, S., Vandame, M., Kositsup, B., Kasemsap, P., Cavaloc, E., Julien, J. L., Améglio, T., & Roeckel-Drevet, P. (2009). Effect of chilling on photosynthesis and antioxidant enzymes in *Hevea brasiliensis* Muell. Arg. *Trees - Structure and Function*, *23*(4), 863–874. https://doi.org/10.1007/s00468-009-0328-x

Malaysian Rubber Board. (2019). *Natural Rubber Statistic 2018*. http://www.lgm.gov.my/nrstat/Statistics Website 2018 (Jan-Dec).pdf

Marok, M. A., Tarrago, L., Ksas, B., Henri, P., Abrous-belbachir, O., Havaux, M., & Rey, P. (2013). A drought-sensitive barley variety displays oxidative stress and strongly increased contents in low-molecular weight antioxidant compounds during water deficit compared to a tolerant variety. *Journal of Plant Physiology*, *170*(7), 633–645. https://doi.org/10.1016/j.jplph.2012.12.008

Martin, F., Clement-Vidal, A., Sanier, C., Fabre, D., Montoro, P., & Leclercq, J. (2015). Engineering rubber plant with high antioxidant capacity. *Proceeding of the International Rubber Conference*, 75–79.

Mathew, G., & Gnanaharan, R. (2000). *Protection of Rubber Wood from Insect Borers* (Issue KFRI Research Report 189).

Mathew, J., Abraham, T., Jacob, C. K., & Reghu, C. P. (2006). Tapping panel dryness: the symptomps. In J. Jacob, R. Krishnakumar, & N. M. Mathew (Eds.), *Tapping Panel Dryness of Rubber Trees* (p. 296). Rubber Research Institute of India.

Mc Mullen, A. I. (1960). Thiols of low molecular weight in *Hevea brasiliensis* latex. *Biochimica et Biophysica Acta*, *41*, 152–154.

Mhamdi, A., & Van Breusegem, F. (2018). Reactive oxygen species in plant development. *Development*, *145*(15), 1–12. https://doi.org/10.1242/dev.164376

Miguel, A. A., Oliveira, L. E. M. de, Cairo, P. A. R., & Oliveira, D. M. de. (2007). Photosynthetic behaviour during the leaf ontogeny of rubber tree clones [*Hevea brasiliensis* (Wild. ex. Adr. de Juss.) Muell. Arg.], in Lavras, MG. *Ciência e Agrotecnologia*, *31*(1), 91–97. https://doi.org/10.1590/S1413-70542007000100014

Montoro, P., Wu, S., Favreau, B., Herlinawati, E., Labrune, C., Martin-Magniette, M.-L. L., Pointet, S., Rio, M., Leclercq, J., Ismawanto, S., & Kuswanhadi. (2018). Transcriptome analysis in *Hevea brasiliensis* latex revealed changes in hormone signalling pathways during ethephon stimulation and consequent Tapping Panel Dryness. *Scientific Reports*, *8*, 8483. https://doi.org/10.1038/s41598-018-26854-y

Moraes, L. A. C., Moreira, A., de Figueiredo Moraes, V. H., Tsai, S. M., & Cordeiro,

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
JUNAIDI, Prof. Siti Subandiyah; Dr. Tri Rini Nuringtyas; Dr. Pascal Montoro
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

E. R. (2014). Relationship between cyanogenesis and latex stability on tapping panel dryness in rubber trunk girth. *Journal of Plant Interactions*, 418–424. https://doi.org/10.1080/17429145.2013.846420

Munné-Bosch, S., & Alegre, L. (2002). The function of tocopherols and tocotrienols in plants. *Critical Reviews in Plant Sciences*, *21*(1), 31–57. https://doi.org/10.1080/0735-260291044179

Nadarajah, M., Tirimanne, S. L., Coomarasamy, A., & Kasinathan, S. (1971). Some naturally occuring antioxidants in *Hevea brasiliensis* latex. *Journal of Rubber Research Institute of Ceylon*, *48*, 202–211.

Nguyen, V. H. T., Diem, N. V. L., Thao, T. T. N., Thuy, T. K., Nang, N., & Thanh, K. D. (2016). Seasonal variation and evolution of some latex physiological parameters of Hevea brasiliensis over consecutive tapping years. *Proceeding of CRRI & IRRDB International Rubber Conference 2016, Siem Reap, Cambodia*, 190–204.

Nhean, S., Ayutthaya, S. I. N., Songsrn, P., Gonkhamdee, S., & Sdoodee, S. (2017). Efficiency of double cut alternative tapping system to improve latex productivity of rubber tree clone RRIT 251 in marginal area, Thailand. *Asia-Pacific Journal of Science and Technology*, *22*(03), 1–6.

Nie, Z., Kang, G., Duan, C., Li, Y., Dai, L., & Zeng, R. (2016). Profiling ethylene-responsive genes expressed in the latex of the mature virgin rubber trees using cDNA microarray. *Plos One*, *11*(3), e0152039. https://doi.org/10.1371/journal.pone.0152039

Noctor, G., & Foyer, C. H. (1998). Ascorbate and glutathione: keeping active oxygen under control. *Annual Review of Plant Biology*, *49*, 249–279. https://doi.org/10.1146/annurev.arplant.49.1.249

Noctor, G., Mhamdi, A., Chaouch, S., Han, Y. I., Neukermans, J., Marquez-Garcia, B., Queval, G., & Foyer, C. H. (2012). Glutathione in plants: an integrated overview. *Plant Cell Environ*, *35*(2), 454–484. https://doi.org/10.1111/j.1365-3040.2011.02400.x

Obouayeba, S, Soumahin, E. F., Dobo, M., Lacote, R., Gabla, O., & Doumbia, A. (2009). Agronomic performance of the clone IRCA 111 of *Hevea brasiliensis* under different frequencies of tapping and stimulation in South-West Côte d'Ivoire. *Journal of Rubber Research*, *12*(2), 93–102.

Obouayeba, Samuel, Soumahin, E. F., Boko, A. M. C., Dea, G. B., Dian, K., Gnagne, Y. M., Kouadio, D., & Gnagne, Y. M. (2008). Improvement of productivity of rubber trees in smallholding by the introduction of upward tapping in the south-east of Cote d'Ivoire. *Journal of Rubber Research*, *11*(3), 163–170.

Obouayeba, Samuel, Soumahin, E., Okoma, K. M., Boko, A. M. C., Dick, K. E., & Lacote, R. (2011). Relationship between tapping intensity and tapping panel dryness susceptibility of some clones of *Hevea brasiliensis* in Southwestern Côte d'Ivoire. *Agriculture and Biology Journal of North America*, *2*(8), 1151–1159. https://doi.org/10.5251/abjna.2011.2.8.1151.1159

Okoma, K. M., Dian, K., Obouayeba, S., Elabo, A. A. E., & N'guetta, A. S. P.

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
JUNAIDI, Prof. Siti Subandiyah; Dr. Tri Rini Nuringtyas; Dr. Pascal Montoro
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

(2011). Seasonal variation of tapping panel dryness expression in rubber tree *Hevea brasiliensis* Muell. Arg. in Cote d'Ivoire. *Agriculture and Biology Journal of North America*, *2*(3), 559–569. https://doi.org/10.5251/abjna.2011.2.3.559.569

Oktavia, F. (2020). Studi pendahuluan konstruksi peta tautan genetik dan identifikasi Quantutative Trait Loci yang terpaut dengan pertumbuhan awal tanaman karet. *Jurnal Penelitian Karet*, *38*(2), 121–132. https://doi.org/10.22302/ppk.jpk.v2i38.733

Oktavia, F., Kuswanhadi, Dinarty, D., Widodo, & Sudarsono. (2017). Genetic diversity and population structure of IRRDB 1981 and Wickham rubber germplasm based on EST-SSR. *Agrivita*, *39*(3), 239–251. https://doi.org/10.17503/agrivita.v39i3.881

Pakianathan, S. W., Haridas, G., & D'Auzac, J. (1989). Water relations and latex flow. In J. D'Auzac, J. L. Jacob, & H. Chrestin (Eds.), *Physiology of Rubber Tree Latex* (pp. 233–256). CRC Press Inc.

Patel, R., Rinker, L., Peng, J., & Chilian, W. M. (2018). Reactive oxygen species: the good and the bad. In *Reactive Oxygen Species (ROS) in Living Cells* (pp. 7–20). InTech Open. https://doi.org/10.5772/intechopen.71547

Pellegrin, F., Duran-Vila, N., Van Munster, M., & Nandris, D. (2007). Rubber tree (*Hevea brasiliensis*) trunk phloem necrosis: Aetiological investigations failed to confirm any biotic causal agent. *Forest Pathology*, *37*(1), 9–21. https://doi.org/10.1111/j.1439-0329.2007.00471.x

Phearun, P., Chetha, P., Bunthuon, H., Lacote, R., Chan, C., Sopheaveasna, M., & Gohet, E. (2016). Early clonal selection of *Hevea brasiliensis* based on latex physiological parameters in Cambodia. *Prodeeding of the CRRI & IRRDB International Rubber Conference*, 286–297.

Pinizzotto, S. (2019). The condition and outlook of world natural rubber supply and demand. *Presented in 16th Shanghai Derivatives Market Forum, 29th May 2019*, 26.

Prado, E., & Demarco, D. (2018). Laticifers and secretory ducts: similarities and differences. In *Ecosystem Services and Global Ecology* (pp. 103–123). InTech Open. https://doi.org/10.5772/intechopen.75705

Priyadarshan, P. M. (2011). *Biology of* Hevea *Rubber*. CAB International. https://doi.org/10.1007/978-3-319-54506-6

Pulchérie, K. N. K., Perpetue, M. A., Moussa, D., Malydie, L. I., Djézou, K., Antoine, K., Hilaire, K. T., & Samuel, O. (2021). Effect of late upward tapping on the productivity of the metabolically active *Hevea brasiliensis* clone PB 260 in Southwestern Cote d'Ivoire. *Annual Research & Review in Biology*, *36*(10), 107–117. https://doi.org/10.9734/arrb/2021/v36i1030440

Putranto, R. A., Duan, C., Kuswanhadi, Chaidamsari, T., Rio, M., Piyatrakul, P., Herlinawati, E., Pirrello, J., Dessailly, F., Leclercq, J., Bonnot, F., Tang, C., Hu, S., & Montoro, P. (2015). Ethylene response factors are controlled by multiple harvesting stresses in *Hevea brasiliensis*. *Plos One*, *10*(4), e0123618.

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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https://doi.org/10.1371/journal.pone.0123618

Putranto, R. A., Herlinawati, E., Rio, M., Leclercq, J., Piyatrakul, P., Gohet, E., Sanier, C., Oktavia, F., Pirrello, J., Kuswanhadi, & Montoro, P. (2015). Involvement of ethylene in the latex metabolism and tapping panel dryness of *Hevea brasiliensis*. *International Journal of Molecular Sciences*, *16*(8), 17885–17908. https://doi.org/10.3390/ijms160817885

Queval, G., & Noctor, G. (2007). A plate reader method for the measurement of NAD, NADP, glutathione, and ascorbate in tissue extracts: application to redox profiling during *Arabidopsis* rosette development. *Analytical Biochemistry*, *363*(1), 58–69. https://doi.org/10.1016/j.ab.2007.01.005

Ramachandran, P., Francis, L., Mathur, S., Varma, A., Mathew, J., Mathew, N. M., & Sethurajm, M. R. (2000). Evidence for association of a low molecular weight RNA with tapping panel dryness syndrome of rubber. *Plant Disease*, *84*, 1155.

Ramachandran, P., Varma, A., Ahlawat, Y. S., Mathew, J., Sethuraj, M. R., Mathew, N. M., Abraham, T., Philip, S., & Jacob, C. K. (2006). Detection of a low molecular weight viroid-like RNA in *Hevea brasiliensis*. In J. Jacob, R. Krisnhakumar, & N. M. Mathew (Eds.), *Tapping Panel Dryness of Rubber Trees* (p. 196). Rubber Research Institute of India.

Ramos, M. V., Demarco, D., da Costa Souza, I. C., & de Freitas, C. D. T. (2019). Laticifers, latex, and their role in plant defense. *Trends in Plant Science*, *24*(6), 553–567. https://doi.org/10.1016/j.tplants.2019.03.006

Rattanawong, R., Prapan, K., Lekawipat, N., Teerawatanasuk, K., Kasemsap, P., Seguin, M., & Clément-Demange, A. (2008). QTLs detection for growth and initial latex production in rubber (*Hevea brasiliensis*). *Proceeding of International Natural Rubber Conference 2008*, 1–28.

Rosa, J. R. B. F., Mantello, C. C., Garcia, D., de Souza, L. M., da Silva, C. C., Gazaffi, R., da Silva, C. C., Toledo-Silva, G., Cubry, P., Garcia, A. A. F., de Souza, A. P., & Le Guen, V. (2018). QTL detection for growth and latex production in a full-sib rubber tree population cultivated under suboptimal climate conditions. *BMC Plant Biology*, *18*(1), 223. https://doi.org/10.1186/s12870-018-1450-y

Roy, S., Arora, A., Chinnusamy, V., & Singh, V. P. (2017). Endogenous reduced ascorbate: an indicator of plant water deficit stress in wheat. *Indian Journal of Plant Physiology*, *22*(3), 365–368. https://doi.org/10.1007/s40502-017-0308-x

Rudall, P. J. (1987). Laticifers in Euphorbiaceae: a conspectus. *Botanical Journal of the Linnean Society*, *94*(1–2), 143–163. https://doi.org/10.1111/j.1095-8339.1987.tb01043.x

Rukkhun, R., Iamsaard, K., Sdoodee, S., Mawan, N., & Khongdee, N. (2020). Effect of high-frequency tapping system on latex yield, tapping panel dryness, and biochemistry of young hillside tapping rubber. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, *48*(4), 2359–2367. https://doi.org/10.15835/nbha48412045

Rukkhun, R., Khongdee, N., Lamsaard, K., Mawan, N., Sainoi, T., & Sdoodee, S.

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JUNAIDI, Prof. Siti Subandiyah; Dr. Tri Rini Nuringtyas; Dr. Pascal Montoro
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

(2021). Latex diagnosis at the whole trunk level under different tapping systems in young-tapping rubber trees. *Indian Journal of Agricultural Research*, *55*(1), 59–66. https://doi.org/10.18805/IJARe.A-592

Sainoi, T., Sdoodee, S., Lacote, R. R., & Gohet, E. (2017). Low frequency tapping systems applied to young-tapped trees of *Hevea brasiliensis* (Willd. ex A. Juss.) Müll. Arg. in Southern Thailand. *Agriculture and Natural Resources*, *51*(4), 268–272. https://doi.org/10.1016/J.ANRES.2017.03.001

Sanier, C., Oliver, G., Fabre, D., Clement-Vidal, A., Fabre, D., Lardet, L., & Montoro, P. (2013). Influence of water deficit on the physiological and biochemical parameters of in vitro plants from *Hevea brasiliensis* clone PB 260. *Journal of Rubber Research*, *16*(1), 61–74.

Sanoubar, R., Cellini, A., Veroni, A. M., Spinelli, F., Masia, A., Antisari, L. V., & Orsini, F. (2016). Salinity thresholds and genotypic variability of cabbage (*Brassica oleracea* L.) grown under saline stress. *Journal of the Science of Food and Agriculture*, *96*, 319–330. https://doi.org/10.1002/jsfa.7097

Santos, J., Oliveira, L. E., Tadeu Coelho, V., Lopes, G., Souza, T., Porto, A. C., Lira, J., Massote, R., Rocha, C., & Gomes, M. P. (2021). Performance of *Hevea brasiliensis* under drought conditions on osmoregulation and antioxidant activity through evaluation of vacuolar invertase and reducing sugars. *Plant Science Today*, *8*(2), 312–323. https://doi.org/10.14719/pst.2021.8.2.1020

Sarker, U., Islam, M. T., Rabbani, M. G., & Oba, S. (2014). Genotypic variability for nutrient, antioxidant, yield and yield contributing traits in vegetable amaranth. *Journal of Food, Agriculture and Environment*, *12*(3–4), 168–174.

Sayurandi, Wirnas, D., & Woelan, S. (2017). Interaksi genotipe x musim karakter fisiologi lateks dan daya hasil beberapa genotipe karet hasil persilangan tahun 1992. *Warta Perkaretan*, *36*(2), 99–112. https://doi.org/10.22302/ppk.wp.v36i2.388

Sdoodee, R. (2004). *Phytophthora* diseases of rubber. In André Drenth & D. I. Guest (Eds.), *Diversity and Management of* Phytophthora *in Southeast Asia* (pp. 136–142). Australian Centre for International Agricultural Research.

Sharma, P., Jha, A. B., Dubey, R. S., & Pessarakli, M. (2012). Reactive oxygen species, oxidative damage, and antioxidative defense mechanism in plants under stressful conditions. *Journal of Botany*, *2012*(217037), 1–26. https://doi.org/10.1155/2012/217037

She, F., Zhu, D., Kong, L., Wang, J., An, F., Lin, W., Wan, J., An, F., & Lin, W. (2013). Ultrasound-assisted tapping of latex from para rubber tree *Hevea brasiliensis*. *Industrial Crops and Products*, *50*, 803–808. https://doi.org/10.1016/j.indcrop.2013.08.065

Shuib, N. H., Ismail, A. I., Adinan, A., & Abd Hadi, S. M. H. S. (2018). Study on biochemical properties of *Hevea brasiliensis* seeds stored at three different temperatures. *Research Journal of Seed Science*, *11*(1), 1–11. https://doi.org/10.3923/rjss.2018.1.11

Simmons, B. (2008). *Book Review: "The Thief at the End of the World", Henry*

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Wickham's adventures. The Seattle Times.

Slimen, I. B., Najar, T., Ghram, A., Dabbebi, H., Ben Mrad, M., & Abdrabbah, M. (2014). Reactive oxygen species, heat stress and oxidative-induced mitochondrial damage: a review. *International Journal of Hyperthermia*, *30*(7), 513–523. https://doi.org/10.3109/02656736.2014.971446

Smirnoff, N. (2000). Ascorbate biosynthesis and function in photoprotection. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *355*(1402), 1455–1464. https://doi.org/10.1098/rstb.2000.0706

Sreelatha, S., Jacob, J., Prakash, G., Simon, S. P., Annamalainathan, K., & Chandrasekhar, T. R. (2003). Antioxidant defence systems and drought tolerance in *Hevea brasiliensis*. *Indian Journal of Natural Rubber Research*, *16*(1–2), 93–101.

Sreelatha, S., Mydin, K. K., Simon, S. P., Krishnakumar, R., Jacob, J., & Annamalainathan, K. (2011). Seasonal variations in yield and associated biochemical changes in RRII 400 series clones of *Hevea brasiliensis*. *Natural Rubber Research*, *24*(1), 117–123.

Sreelatha, S., Simon, S. P., Mercykutty, V. C., Mydin, K. K., Krishnakumar, R., Annamalainathan, K., & Jacob, J. (2016). Role of lutoid membrane transport and protein synthesis in the regeneration mechanism of latex in different *Hevea* clones. *Acta Physiologiae Plantarum*, *38*(6). https://doi.org/10.1007/s11738-016-2161-3

Suwandi, S., Junita, A., Suparman, S., Umayah, A., Hamidson, H., Muslim, A., & Irsan, C. (2018). Curative activity of watery fermented compost extract as a bark treatment against tapping panel dryness. *The Open Agriculture Journal*, *12*(1), 74–83. https://doi.org/10.2174/1874331501812010074

Syafaah, A., Ismawanto, S., & Herlinawati, E. (2015). Keragaman sifat pertumbuhan, fisiologi, dan daya hasil progeni karet (*Hevea brasiliensis* Muell. Arg.) hasil persilangan antara klon PB 260 dan RRIC 100. *Jurnal Penelitian Karet*, *33*(2), 121–130. https://doi.org/10.22302/jpk.v33i2.177

Tan, D. G., Hu, X. W., Fu, L. L., Kumpeangkeaw, A., Ding, Z. H., Sun, X. P., & Zhang, J. M. (2017). Comparative morphology and transcriptome analysis reveals distinct functions of the primary and secondary laticifer cells in the rubber tree. *Scientific Reports*, *7*(1), 3126. https://doi.org/10.1038/s41598-017-03083-3

Tang, C., Yang, M., Fang, Y., Luo, Y., Gao, S., Xiao, X., An, Z., Zhou, B., Zhang, B., Tan, X., Yeang, H.-Y. Y., Qin, Y., Yang, J. J., Lin, Q., Mei, H., Montoro, P., Long, X., Qi, J., Hua, Y., … Huang, H. (2016). The rubber tree genome reveals new insights into rubber production and species adaptation. *Nature Plants*, *2*(6). https://doi.org/10.1038/NPLANTS.2016.73

Taussky, H. H., & Shorr, E. (1953). A micro colorimetric methods for the determination of inorganic phosphorus. *Journal of Biological Chemistry*, *202*(2), 675–685.

Thepchalerm, C., Vaysse, L., Wisunthorn, S., Kiatkamjornwong, S., Nakason, C., &

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Bonfils, F. (2015). The stability of lutoids in *Hevea brasiliensis* latex influences the storage hardening of natural rubber. *Journal of Rubber Research*, *18*(1), 17–26.

Tian, W.-M., Yang, S.-G., Shi, M.-J., Zhang, S.-X., & Wu, J.-L. (2015). Mechanical wounding-induced laticifer differentiation in rubber tree: an indicative role of dehydration, hydrogen peroxide, and jasmonates. *Journal of Plant Physiology*, *182*, 95–103. https://doi.org/10.1016/j.jplph.2015.04.010

Tistama, R., Siregar, A. P. M., Ade Fipriani, L., & Junaidi. (2019). Physiological status of high and low metabolisme *Hevea* in the difference stage of tapping panel dryness. *Biodiversitas*, *20*(1), 267–273. https://doi.org/10.13057/biodiv/d200143

Traore, M. S., Diarrassouba, M., Okoma, K. M., Dick, K. E., Soumahin, E. F., Coulibaly, L. F., & Obouayeba, S. (2011). Long-term effect of different annual frequencies of ethylene stimulation on rubber productivity of clone GT 1 of *Hevea brasiliensis* (Muell. Arg.) in South East of Côte d'Ivoire. *Agriculture and Biology Journal of North America*, *2*(8), 1251–1260. https://doi.org/10.5251/abjna.2011.2.8.1251.1260

Tungngoen, K., Viboonjun, U., Kongsawadworakul, P., Katsuhara, M., Julien, J. L., Sakr, S., Chrestin, H., & Narangajavana, J. (2011). Hormonal treatment of the bark of rubber trees (*Hevea brasiliensis*) increases latex yield through latex dilution in relation with the differential expression of two aquaporin genes. *Journal of Plant Physiology*, *168*(3), 253–262. https://doi.org/10.1016/j.jplph.2010.06.009

USDA. (2019). *Classification for Kingdom Plantae Down to Species* Hevea brasiliensis *(Willd. ex A. Juss.) Mull. Arg.* United States Department of Agriculture (USDA) Classification Report. https://plants.usda.gov/

Venkatachalam, P., Priya, P., Jayashree, R., Rekha, K., & Thulaseedharan, A. (2009). Molecular cloning and characterization of a 3-hydroxy-3-methylglutaryl-coenzyme A reductase 1 (*hmgr1*) gene from rubber tree (*Hevea brasiliensis* Muell. Arg.): a key gene involved in isoprenoid biosynthesis. *Physiology and Molecular Biology of Plants*, *15*(2), 133–143. https://doi.org/10.1007/s12298-009-0015-9

Vijayakumar, K. R., Gohet, E., Thomas, K. U., Xiaodi, W., Sumarmadji, Rodrigo, L., Thanh, D. K., Sopchoke, P., Karunaichamy, K., & Said, M. A. M. (2009). Special communication: revised international notation for latex harvest technology. *Journal of Rubber Research*, *12*(2), 103–115.

Vinod, K. K., Pothen, J., Chaudhuri, D., Priyadarshan, P. M., Eappen, T., Varghese, M., Mandal, D., Sharma, A. C., Pal, T. K., Devakumar, A. S., & Krishnakumar, A. K. (2000). Variation and trend of yield and related traits of *Hevea brasiliensis* Muell. Arg. in Tripura. *Indian Journal of Natural Rubber Research*, *13*(1 & 2), 69–78.

Wang, D., Xie, Q., Sun, Y., Tong, Z., Chang, L., Yu, L., Zhang, X., Yuan, B., He, P., Jin, X., Dong, Y., Li, H., Montoro, P., & Wang, X. (2019). Proteomic landscape

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
JUNAIDI, Prof. Siti Subandiyah; Dr. Tri Rini Nuringtyas; Dr. Pascal Montoro
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

has revealed small rubber particles are crucial rubber biosynthetic machines for ethylene-stimulation in natural rubber production. *International Journal of Molecular Sciences*, *20*, 5082. https://doi.org/10.3390/ijms20205082

Wang, X., Wang, D., Sun, Y., Yang, Q., Chang, L., Wang, L., Meng, X., Huang, Q., Jin, X., & Tong, Z. (2015). Comprehensive proteomics analysis of laticifer latex reveals new insights into ethylene stimulation of natural rubber production. *Scientific Reports*, *5*, 13778. https://doi.org/10.1038/srep13778

Wani, S. H., Kumar, V., Shriram, V., & Sah, S. K. (2016). Phytohormones and their metabolic engineering for abiotic stress tolerance in crop plants. *Crop Journal*, *4*(3), 162–176. https://doi.org/10.1016/j.cj.2016.01.010

Wititsuwannakul, R., Pasitkul, P., Kanokwiroon, K., & Wititsuwannakul, D. (2008). A role for a *Hevea* latex lectin-like protein in mediating rubber particle aggregation and latex coagulation. *Phytochemistry*, *69*(2), 339–347. https://doi.org/10.1016/j.phytochem.2007.08.019

Wychherley, P. R. (1992). The genus *Hevea*: botanical aspects. In M. R. Sethuraj & N. M. Mathew (Eds.), *Natural Rubber: Biology, Cultivation and technology* (pp. 50–115). Elsevier Science Publisher B.V.

Xia, Z., Liu, K., Zhang, S., Yu, W., Zou, M., He, L., & Wang, W. (2018). An ultra-high density map allowed for mapping QTL and candidate genes controlling dry latex yield in rubber tree. *Industrial Crops and Products*, *120*, 351–356. https://doi.org/10.1016/j.indcrop.2018.04.057

Xie, T., Gu, W., Zhang, L., Li, L., Qu, D., Li, C., Meng, Y., Li, J., Wei, S., & Li, W. (2018). Modulating the antioxidant system by exogenous 2-(3,4-dichlorophenoxy) triethylamine in maize seedlings exposed to polyethylene glycol-simulated drought stress. *Plos One*, *13*(9), 1–22. https://doi.org/10.1371/journal.pone.0203626

Yamashita, S., & Takahashi, S. (2020). Molecular mechanisms of natural rubber biosynthesis. *Annual Review of Biochemistry*, *89*(1), 821–851. https://doi.org/10.1146/annurev-biochem-013118-111107

Yang, H., Dai, L., Wei, Y., Deng, Z., & Li, D. (2020). Melatonin enhances salt stress tolerance in rubber tree (*Hevea brasiliensis*) seedlings. *Industrial Crops and Products*, *145*, 111990. https://doi.org/10.1016/j.indcrop.2019.111990

Yang, W. F., Liu, H. W., Wu, M., Luo, M. H., Luo, S. Q., Wei, F., Qiu, J., Gao, H. H., & Xiao, X. Z. (2017). Effects of ethrel stimulation with different concentrations on yield and physiological parameters of rubber tree Dafeng 95. *Journal of Southern Agriculture*, *48*(11), 2052–2057. https://doi.org/10.3969/j.issn.2095-1191.2017.11.21

Yeang, H.-Y. (2007). Synchronous flowering of the rubber tree (*Hevea brasiliensis*) induced by high solar radiation intensity. *New Phytologist*, *175*(2), 283–289. https://doi.org/10.1111/j.1469-8137.2007.02089.x

Yeang, H. (2005). The kinetics of latex flow from the rubber tree in relation to latex vessel plugging and turgor pressure. *Journal of Rubber Research*, *8*(3), 160–181.

Yuan, K., He, J., Hu, Y., Feng, C., & Wang, Z. (2021). The variation of reactive

UNIVERSITAS GADJAH MADA
Study of Physiological Parameters and Antioxidants in Response to Harvest Stress and Tapping Panel Dryness in Latex of Hevea Brasiliensis (Willd. ex A. Juss.) Muell Arg.
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Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

oxygen species scavenging enzymes and related gene expressions during occurrence and recovery of rubber tree tapping panel dryness. *Journal of Rubber Research*, *0123456789*. https://doi.org/10.1007/s42464-021-00106-7

Zain, W. Z. W. M., Ramli, N. N. binti, Jusoh, S., & Hamid, N. A. binti. (2021). Antioxidant activity, total phenolic and flavonoid content from leaves and seed extracts of *Hevea brasiliensis* clone. *Journal of Academia*, *9*(1), 1–7.

Zaw, Z. N., Sdoodee, S., & Lacote, R. (2017). Performances of low frequency rubber tapping system with rainguard in high rainfall area in Myanmar. *Australian Journal of Crop Science*, *11*(11), 1451–1456. https://doi.org/10.21475/ajcs.17.11.11.pne593

Zhang, Y., Leclercq, J., & Montoro, P. (2017). Reactive oxygen species in *Hevea brasiliensis* latex and relevance to tapping panel dryness. *Tree Physiology*, *37*(2), 261–269. https://doi.org/10.1093/treephys/tpw106

Zhang, Y., Leclercq, J., Wu, S., Ortega-Abboud, E., Pointet, S., Tang, C., Hu, S., & Montoro, P. (2019). Genome-wide analysis in *Hevea brasiliensis* laticifers revealed species-specific post-transcriptional regulations of several redox-related genes. *Scientific Reports*, *9*(1), 5701. https://doi.org/10.1038/s41598-019-42197-8

Zhang, Y., Xin, L., Pirrello, J., Fang, Y., Yang, J., Qi, J., Montoro, P., & Tang, C. (2021). Ethylene response factors regulate expression of HbSUT3, the sucrose influx carrier in laticifers of *Hevea brasiliensis*. *Tree Physiology*, *41*(7), 1278–1288. https://doi.org/10.1093/treephys/tpaa179

Zhu, J. K. (2016). Abiotic stress signaling and responses in plants. *Cell*, *167*(2), 313–324. https://doi.org/10.1016/j.cell.2016.08.029

Zhu, J., & Zhang, Z. (2009). Ethylene stimulation of latex production in *Hevea brasiliensis*. *Plant Signaling and Behavior*, *4*(11), 1072–1074. https://doi.org/10.1016/j.plaphy.2009.06.003

Zou, Z., Gong, J., An, F., Xie, G., Wang, J., Mo, Y., & Yang, L. (2015). Genome-wide identification of rubber tree (*Hevea brasiliensis* Muell. Arg.) aquaporin genes and their response to ethephon stimulation in the laticifer, a rubber-producing tissue. *BMC Genomics*, *16*(1), 1–18. https://doi.org/10.1186/s12864-015-2152-6