

DAFTAR PUSTAKA

- Abbott, W.S. 1925. A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology*. 18: 256-267.
- Afzal, M. B. S., Abbas, N., & Shad, S. A. 2015. Inheritance, realized heritability and biochemical mechanism of acetamiprid resistance in the cotton mealybug, *Phenacoccus solenopsis* Tinsley (Homoptera: Pseudococcidae). *Pesticide Biochemistry and Physiology*. 122: 44-49.
- Aldini, G.M., Martono, E. & Trisyono, Y.A., 2019. Diversity of natural enemies associated with refuge flowering plants of *Zinnia elegans*, *Cosmos sulphureus*, and *Tagetes erecta* in rice ecosystem. *Jurnal Perlindungan Tanaman Indonesia*, 23(2), pp.285-291.
- Aldini, G.M., Trisyono, Y.A., Wijonarko, A., Witjaksono, W. & de Putter, H., 2020. Farmers' practices in using insecticides to control *Spodoptera exigua* infesting shallot *Allium cepa* var. *aggregatum* in the shallot production centers of Java. *Jurnal Perlindungan Tanaman Indonesia*, 24(1), pp.75-81.
- Anant, A.K., Parameswaran, C., Basana-Gowda, G., Adak, T., Paneerselvam, P., Annamalai, M., Patil, N. & Rath, P.C., 2022. Population genetic structure and migration pattern of *Nilaparvata lugens* (Stål.) (Hemiptera: Delphacidae) populations in India based on mitochondrial COI gene sequences. *CURRENT SCIENCE*. 123(3): 461.
- Andika, I.P. & Martono, E., 2022. Mapping of Indonesia's Agricultural Insecticides in 2021: Registered Products, Future Research Opportunities, and Information Dissemination. *AGRIVITA Journal of Agricultural Science*. 44(2): 377-389.
- APRD. 2023. *Nilaparvata lugens*. <
<https://www.pesticideresistance.org/display.php?page=species&arId=287>>. (Diakses pada 31 October 2023)
- Backus, E. A., Serrano, M. S. & Ranger, C. M. 2005. Mechanisms of hopperburn: An overview of insect taxonomy, behaviour, and physiology. *Annu. Rev. Entomol.* 50: 125–151.
- Bae, S.H. & M.D. Pathak. 1970. Life history of *Nilaparvata lugens* (Homoptera: Delphacidae) and susceptibility of rice varieties to its attacks. *Annals The Entomological Society of America*. 63 (1): 149-155.
- Baehaki, S.E., Iswanto, E. H., & Munawar, D. 2016. Resistensi wereng coklat terhadap insektisida yang beredar di sentra produksi padi. *Jurnal Penelitian Pertanian Tanaman Pangan*. 35 (2): 99-108.
- Bao, H., Gao H., Zhang Y., Fan D., Fang J., & Zewen L. 2016. The roles of CYP6AY1 and CYP6ER1 in imidacloprid resistance in the brown planthopper: Expression levels and detoxification efficiency. *Pesticide Biochemistry and Physiology* 129:70-74.

- Bass, C., A.M. Puinean, C.T. Zimmer, I. Denholm, L.M. Field, S.P. Foster, O. Gutbrod, R. Nauen, R. Slater & M.S. Williamson. 2014. The evolution of insecticide resistance in the peach potato aphid, *Myzus persicae*. *Insect Biochemistry and Molecular Biology*. 51: 41–51.
- Bass, C., Carvalho, R.A., Oliphant, L., Puinean, A.M., Field, L.M., Nauen, R., Williamson, M.S., Moores, G. & Gorman, K., 2011. Overexpression of a cytochrome P450 monooxygenase, CYP6ER1, is associated with resistance to imidacloprid in the brown planthopper, *Nilaparvata lugens*. *Insect molecular biology*. 20(6): 763-773.
- BB Padi. 2020. Peta Sebaran Wereng Cokelat di Pulau Jawa. <<http://bbpadi.litbang.pertanian.go.id/index.php/basis-data/pemetaan/peta-sebaran-wereng-coklat-di-pulau-jawa>> (diakses pada 23 November 2020).
- BBPOPT. 2021. Laporan Kinerja BBPOPT Tahun 2020. Pp.29-32.
- BBPOPT. 2024. Surat kewaspadaan OPT. <https://bbpopt.tanamanpangan.pertanian.go.id/regulasi/surat-kewaspadaan-opt> (diakses pada 16 April 2024)
- Blibech, I., Ksantini, M., Jardak, T. & Bouaziz, M., 2015. Effect of insecticides on *Trichogramma* parasitoids used in biological control against Prays oleae insect pest. *Advances in Chemical Engineering and Science*. 5(03): 362.
- Bottrell, D.G. & Schoenly, K.G., 2012. Resurrecting the ghost of green revolutions past: The brown planthopper as a recurring threat to high-yielding rice production in tropical Asia. *Journal of Asia-Pacific Entomology*, 15(1), pp.122-140.
- BPOPT. 2019. Laporan Kinerja BBPOPT Tahun 2019. Direktorat Jenderal Tanaman Pangan. Kementerian Pertanian.
- Brar, D.S., Virk, P.S., Jena, K.K. & Khush, G.S., 2009. Breeding for resistance to planthoppers in rice. *Planthoppers: new threats to the sustainability of intensive rice production systems in Asia*, pp.401-409.
- Brattsten, L.B., C.W. Holyoke Jr., J.R. Leeper & K.F. Raffa, 1986. Insecticide resistance: challenge to pest management and basic research. *Science* 231: 1255–1260.
- Brun-Barale, A., O. Hema, T. Martin, S. Suraporn, P. Audant, H. Sezutsu & R. Feyereisen. 2010. Multiple P450 genes overexpressed in deltamethrin resistant strains of *Helicoverpa armigera*. *Pest Management Science*. 66: 900-909.
- Buszewski B, Bukowska M, Ligor M, & Staneczko-Baranowska I (2019) A holistic study of neonicotinoids neuroactive insecticides—properties, applications, occurrence, and analysis. *Environ Sci Pollut Res Int* 26:34723-34740. <https://doi.org/10.1007/s11356-019-06114-w>

- CABI. 2019. Distribution Table of *Nilaparvata lugens* (brown planthopper). <<https://www.cabi.org/isc/datasheet/36301/#5B29C874-DF64-4BD7-934D-8FCB09B3C50B>> (diakses pada 2 Mei 2019).
- CABI. 2020. Distribution Table of *Nilaparvata lugens*. <<https://www.cabi.org/isc/datasheet/36301/#toDistributionMaps>> (diakses pada 23 November 2020).
- Chen, J. C., S.N. Cheng, L.M. Yan & H.T. Yin. 1979. Ovarial development of the brown planthopper (*Nilaparvata-Lugens* Stal) and its relation to migration. Acta Entomol. Sinica. 22: 280–288.
- Crouse, G. D., J.E. Dripps, N. Orr, T.C. Sparks & C. Waldron. 2007. DE-175 (Spinetoram), a new semi-synthetic spinosyn in development. In Modern Crop Protection Compounds; Kramer, W. & Schirmer, U. Eds. Wiley-VCH: Weinheim, Germany. 1013-1031 p.
- Datta, J., Wei, Q., Yang, Q., Wan, P.J., He, J.C., Wang, W.X., Lai, F.X., Ali, M.P. & Fu, Q., 2021. Current resistance status of the brown planthopper *Nilaparvata lugens* (Stål) to commonly used insecticides in China and Bangladesh. Crop Protection, 150, p.105789.
- Devillers, J., David, J.P., Barrès, B., Alout, H., Lapied, B., Chouin, S., Dusfour, I., Billault, C., Mekki, F., Attig, I. & Corbel, V., 2023. Integrated plan of insecticide resistance surveillance in mosquito vectors in France. Insects. 14(5): 457.
- Dharmasena C.M.D., R.M.R. Banda & M.H.J.P. Fernando. 2000. Effect of climatic factors and agronomic practices on brown planthopper (*Nilaparvata lugens*) out break in the Anuradhapura District, Sri Langka. Tropical Agricultural Research and Extension. 3: 12–16.
- Ding, Z., Wen, Y., Yang, B., Zhang, Y., Liu, S., Liu, Z. & Han, Z., 2013. Biochemical mechanisms of imidacloprid resistance in *Nilaparvata lugens*: over-expression of cytochrome P450 CYP6AY1. Insect Biochemistry and Molecular Biology. 43(11): 1021-1027.
- Diptaningsari, D., Y.A. Trisyono, A. Purwantoro & A. Wijanarko. 2019. Inheritance and realized heritability of resistance to Imidacloprid in the Brown Planthopper, *Nilaparvata lugens* (Hemiptera: Delphacidae), from Indonesia. Journal of Economic Entomology. 20 (20): 1-7.
- Diptaningsari, D., Y.A. Trisyono, A. Purwantoro & A. Wijanarko. 2020. Stability of resistance to imidacloprid in the brown planthopper (*Nilaparvata lugens* Stal) from Banyumas, Central Java. Jurnal Perlindungan Tanaman Indonesia. 24: 61-67.
- Ditjen PSP (Direktorat Jendral Prasarana dan Sarana Prasarana). 2017. Pestisida Pertanian dan Kehutanan. Kementrian Pertanian RI, Jakarta. 1096p.
- Dono, D., Widayani, N. S., Ishmayana, S., Hidayat, Y., Widiyantini, F., & Nasahi, C. 2022. Resistance of *Nilaparvata lugens* to fenobucarb and imidacloprid

and susceptibility to neem oil insecticides. HAYATI Journal of Biosciences, 29(2), pp.234-244.

EFSA Panel on Plant Health (PLH). 2023. Pest categorisation of *Nilaparvata lugens*. EFSA Journal, 21(5), p.e07999.

[EPPO, 2020. EPPO Global database. In: EPPO Global database, Paris, France: EPPO. <<https://gd.eppo.int/>>](#) (diakses pada 23 November 2020).

FAO. 2018. Food and agriculture organization of the United Nations. Rome <http://faostat.fao.org>. (diakses 12 Agustus 2024).

Feyereisen, R. 1999. Insect P450 enzymes. Annual Review of Entomology. 44: 507-533.

Feyereisen, R. 2012. Insect CYP Genes and P450 Enzymes. In: Gilbert, L.I. (Ed.), Insect Molecular Biology and Biochemistry. Academic Press, San Diego. 236-316 p.

Finney, D. J. (1971). Probit Analysis, 3rd edition. Cambridge University Press, London. Pp.333

Folmer, O., M. Black, W. Hoeh, R. Lutz & R. Vrijenhoek. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. Molecular Marine Biology and Biotechnology. 3: 294-299.

Fu, Y.X., 1997. Statistical tests of neutrality of mutations against population growth, hitchhiking and background selection. *Genetics*, 147(2), pp.915-925.

Fujii, T., Matsumura, M., & Sanada-Morimura, S. 2025. Phenotypic analysis of dinotefuran resistance in the brown planthopper, *Nilaparvata lugens* (Hemiptera: Delphacidae), using the experimental evolution approach. *Annals of Applied Biology*, 1-9.

Fujii, T., Sanada-Morimura, S., Matsukura, K., Van Chien, H., Cuong, L.Q., Loc, P.M., Estoy Jr, G.F. & Matsumura, M., 2020. Energy reserve compensating for trade-off between metabolic resistance and life history traits in the brown planthopper (Hemiptera: Delphacidae). *Journal of Economic Entomology*, 113(4), pp.1963-1971.

Gao, C.F., Ma, S.Z., Shan, C.H. & Wu, S.F., 2014. Thiamethoxam resistance selected in the western flower thrips *Frankliniella occidentalis* (Thysanoptera: Thripidae): cross-resistance patterns, possible biochemical mechanisms and fitness costs analysis. *Pesticide biochemistry and physiology*, 114, pp.90-96.

Garrod, W.T., C.T. Zimmer, K.J. Gorman, R. Nauen, C. Bass & T.G. Davies. 2015. Field-evolved resistance to imidacloprid and ethiprole in populations of brown planthopper *Nilaparvata lugens* collected from across South and East Asia. *Pest Management Science*. 72: 140-149.

- Gorman, K., Liu, Z., Denholm, I., Brügggen, K.U. & Nauen, R., 2008. Neonicotinoid resistance in rice brown planthopper, *Nilaparvata lugens*. *Pest Management Science: formerly Pesticide Science*. 64(11): 1122-1125.
- Gu, F., Lu, H., Lyu, B., Zhang, Q., Jiao, B. & Tang, J., 2024. Seasonal migration pattern of an important rice pest, *Nilaparvata lugens* (Hemiptera: Delphacidae), on Hainan Island, China. *Journal of Economic Entomology*. 117(3): 933-941.
- Hebert, P.D.N. A. Cywinska, S.L. Ball & J.R. deWaard. 2003. Biological identifications through DNA barcodes. *Proc. R. Soc. Lond.* 270: 313-321.
- Heong, K.L. & Hardy, B. eds., 2009. Planthoppers: new threats to the sustainability of intensive rice production systems in Asia. *Int. Rice Res. Inst.*
- Hereward, J. P., Cai, X., Matias, A. M. A., Walter, G. H., Xu, C., & Wang, Y. (2020). Migration dynamics of an important rice pest: The brown planthopper (*Nilaparvata lugens*) across Asia—Insights from population genomics. *Evolutionary Applications*. 13(9): 2449-2459.
- Hu, C., Guo, J., Fu, X., Huang, Y., Gao, X. & Wu, K., 2018. Seasonal migration pattern of *Nilaparvata lugens* (Hemiptera: Delphacidae) over the Bohai Sea in northern China. *Journal of Economic Entomology*. 111(5): 2129-2135.
- Hu, G., Cheng, X.N., Qi, G.J., Wang, F.Y., Lu, F., Zhang, X.X. & Zhai, B.P., 2011. Rice planting systems, global warming and outbreaks of *Nilaparvata lugens* (Stål). *Bulletin of Entomological Research*. 101(2): 187-199.
- Hu, Q.L., Zhuo, J.C., Fang, G.Q., Lu, J.B., Ye, Y.X., Li, D.T., Lou, Y.H., Zhang, X.Y., Chen, X., Wang, S.L. & Wang, Z.C., 2024. The genomic history and global migration of a windborne pest. *Science Advances*, 10(17), p.eadk3852.
- Hua Wang, Y., Fen Gao, C., Cheng Zhu, Y., Chen, J., Hong Li, W., Lin Zhuang, Y., Dai, D.J., Jun Zhou, W., Yong Ma, C. & Liang Shen, J., 2014. Imidacloprid susceptibility survey and selection risk assessment in field populations of *Nilaparvata lugens* (Homoptera: Delphacidae). *Journal of Economic Entomology*. 101(2): 515-522.
- IRAC. 2020. IRAC Mode of Action Classification Scheme. <www.irac-online.org> (diakses pada 2 November 2020).
- IRAC. 2022. Overview of insect resistance monitoring for insecticides: factors impacting the design and implementation of resistance monitoring program. <<https://irac-online.org/documents/factors-impacting-a-resistance-monitoring-program/?ext=pdf>>. (diakses 3 September 2024).
- IRAC. 2023. IRAC Mode of Action Classification Scheme. <www.irac-online.org> (diakses pada 2 November 2023).
- IRAC. 2025. Mode of Action Classification Scheme. <www.irac-online.org> (diakses pada 27 Mei 2025).

- Jeschke, P. & Nauen, R. 2007. Nicotinic acetylcholine receptor agonists, target and selectivity aspects. In *Modern Crop Protection Compounds*. Kramer, W. & Schirmer, U., Eds. Wiley-VCH: Weinheim, Germany. 927-958 p.
- Jin, R., Mao, K., Liao, X., Xu, P., Li, Z., Ali, E., Wan, H. & Li, J., 2019. Overexpression of CYP6ER1 associated with clothianidin resistance in *Nilaparvata lugens* (Stål). *Pesticide biochemistry and physiology*. 154: 39-45.
- Kagabu, S. 2003. Molecular design of neonicotinoids: past, present and future. In *Chemistry of Crop Protection: Progress and Prospects in Science and Regulation*. Voss, G., Ramos, G., Eds. Wiley-VCH: New York. pp 193-212.
- Kalshoven. 1981. *Pest of Crop in Indonesia*. Revised and translated by P.A. Van deer Laan. Ichtiar Baru-Van Hoeve, Jakarta. 701 p.
- Kartavtsev, Y.P. 2021. Some Examples of the Use of Molecular Markers for Needs of Basic Biology and Modern Society. *Animals* 11: 1473.
- Kementrian Pertanian. 2021. Rekapitulasi Ijin Pestisida Berdasarkan Bahan Aktif. <http://pestisida.id/simpes_app/rekap_kimia_formula.php> (diakses pada 2 Januari 2021).
- Khan, M.M., Nawaz, M., Hua, H., Cai, W. & Zhao, J., 2018. Lethal and sublethal effects of emamectin benzoate on the rove beetle, *Paederus fuscipes*, a non-target predator of rice brown planthopper, *Nilaparvata lugens*. *Ecotoxicology and Environmental Safety*. 165: 19-24.
- Kliot, A. & Ghanim, M., 2012. Fitness costs associated with insecticide resistance. *Pest management science*. 68(11): 1431-1437.
- Kumar, S., Stecher, G., Li, M., Knyaz, C. & Tamura, K., 2018. MEGA X: molecular evolutionary genetics analysis across computing platforms. *Molecular biology and evolution*. 35(6): 1547-1549.
- Lao, S.H., X.H. Huang, H.J. Huang, C.W. Liu, C.X. Zhang & Y.Y. Bao. 2015. Genomic and transcriptomic insights into the cytochrome P450 monooxygenase gene repertoire in the rice pest brown planthopper, *Nilaparvata lugens*. *Genomics*. 106: 301–309.
- Liang, Z.K., Pang, R., Dong, Y., Sun, Z.X., Ling, Y. & Zhang, W.Q., 2018. Identification of SNPs involved in regulating a novel alternative transcript of P450 CYP6ER1 in the brown planthopper. *Insect science*. 25(5):726-738.
- Liao, X., Xu, P. F., Gong, P. P., Wan, H., & Li, J. H. (2021). Current susceptibilities of brown planthopper *Nilaparvata lugens* to triflumezopyrim and other frequently used insecticides in China. *Insect Science*. 28(1): 115-126.
- Ling, S. & Zhang, H., 2013. Influences of chlorpyrifos on antioxidant enzyme activities of *Nilaparvata lugens*. *Ecotoxicology and Environmental Safety*. 98: 187-190.

- Listihani, L., Ariati, P.E.P., Yuniti, I.G.A.D. & Selangga, D.G.W., 2022. The brown planthopper (*Nilaparvata lugens*) attack and its genetic diversity on rice in Bali, Indonesia. *Biodiversitas Journal of Biological Diversity*. 23(9): 4696-4704.
- Liu, F., Bao, S.W., Song, Y., Lu, H.Y. & Xu, J.X., 2010. Effects of imidacloprid on the orientation behavior and parasitizing capacity of *Anagrus nilaparvatae*, an egg parasitoid of *Nilaparvata lugens*. *BioControl*. 55: 473-483.
- Liu, N., M. Li, Y. Gong, F. Liu & T. Li. 2015. Cytochrome P450s-Their expression, regulation, and role in insecticide resistance. *Pesticide Biochemistry and Physiology*. 120: 77-81
- Liu, Z. & Han, Z., 2006. Fitness costs of laboratory-selected imidacloprid resistance in the brown planthopper, *Nilaparvata lugens* Stål. *Pest Management Science: formerly Pesticide Science*. 62(3), pp.279-282.
- Liu, Z., M.S. Williamson, S.J. Lansdell, I. Denholm, Z. Han & N.S. Millar. 2005. A nicotinic acetylcholine receptor mutation conferring target-site resistance to imidacloprid in *Nilaparvata lugens* (brown planthopper). *Proc. Natl. Acad. Sci. U.S.A.* 102 (24): 8420-8425.
- Liu, Z., M.S. Williamson, S.J. Lansdell, Z. Han, I. Denholm & N.S. Millar. 2006. A nicotinic acetylcholine receptor mutation (Y151S) causes reduced agonist potency to a range of neonicotinoid insecticides. *J. Neurochem*. 99: 1273-1281
- Liu, Z.W., Z.J. Han, Y.C. Wang, L.C. Zhang, H.W. Zhang & C.J. Liu. 2003. Selection for imidacloprid resistance in *Nilaparvata lugens*: *cross-resistance* pattern and possible mechanism. *Pest Management Science*. 59: 1355-1359.
- Livak K.J. & T.D. Schmittgen. 2001. Analysis of relative gene expression data using real time quantitative PCR and the 2^{-ΔΔCt}(T) Method. *Methods*. 25 (4): 402-408.
- Londingkene, J. A., Y.A. Trisyono, Witjaksono & E. Martono. 2016. Relative fitness and feeding capacity of imidacloprid resistant *Nilaparvata lugens*. *Jurnal Perlindungan Tanaman Indonesia*. 20: 43-49.
- Lv, H., Zhai, M.Y., Zeng, J., Zhang, Y.Y., Zhu, F., Shen, H.M., Qiu, K., Gao, B.Y., Reynolds, D.R., Chapman, J.W. & Hu, G., 2023. Changing patterns of the East Asian monsoon drive shifts in migration and abundance of a globally important rice pest. *Global Change Biology*, 29(10): 2655-2668.
- Mao, K., Zhang, X., Ali, E., Liao, X., Jin, R., Ren, Z., Wan, H. & Li, J., 2019. Characterization of nitenpyram resistance in *Nilaparvata lugens* (Stål). *Pesticide biochemistry and physiology*, 157: 26-32.
- Marçon, P. C., Young, L. J., Steffey, K. L., & Siegfried, B. D. (1999). Baseline susceptibility of European corn borer (Lepidoptera: Crambidae) to *Bacillus thuringiensis* toxins. *Journal of Economic Entomology*, 92(2), 279-285.

- Matsuda, K., S.D. Buckingham, D. Kleier, J.J. Rauh, M. Grauso & D.B. Sattelle. 2001. Neonicotinoids: insecticides acting on insect nicotinic acetylcholine receptors. *Trends Pharmacology Science*. 22:573–80
- Matsumoto, Y., Matsumura, M., Sanada-Morimura, S., Hirai, Y., Sato, Y. & Noda, H., 2013. Mitochondrial *cox* sequences of *Nilaparvata lugens* and *Sogatella furcifera* (Hemiptera, Delphacidae): low specificity among Asian planthopper populations. *Bulletin of Entomological Research*, 103(4), pp.382-392.
- Matsumura, M. & S. Sanada-Morimura. 2010. Recent status of insecticide resistance in Asian rice planthoppers. *JARQ*. 44 (3): 225-230.
- Matsumura, M., H. Takeuchi, M. Satoh, S. Sanada-Morimura, A. Otuka, T. Watanabe & D. V. Thanh. 2008. Species-species insecticide resistance to imidacloprid and fipronil in the rice planthoppers *Nilaparvata lugens* and *Sogatella furcifera* in East and South-east Asia. *Pest Management Science* 64: 1115-1121.
- Matsumura, M., S. Sanada-Morimura, A. Otuka, S. Sonoda, D. V. Thanh, H.V. Chien, P.V. Tuong, P.M. Loc, Z.W. Liu, Z.R. Zhu & J.H. Li. 2018. Insecticide susceptibilities of the two rice planthoppers *Nilaparvata lugens* and *Sogatella furcifera* in East Asia, the Red River Delta, and the Mekong Delta. *Pest Management Science*. 74 (2): 456-464.
- Melhanah, Witjaksono, & Y.A. Trisyono, 2002. Seleksi Resistansi Wereng Batang Padi Coklat terhadap Insektisida Fipronil. *Jurnal Perlindungan Tanaman Indonesia*. 8: 107–113.
- Mochida, O. & Okada, T. (1979) 'Taxonomy and biology of *Nilaparvata lugens* (Hom., Delphacidae).', *Brown Planthopper: Threat to Rice Production in Asia*. Int. Rice Res. Inst, Los Baños, Philippines, pp. 21–43.
- Morrissey CA, Mineau P, Devries JH, Sanchez-Bayo F, Liess M, Cavallaro MC & Liber K (2015) Neonicotinoid contamination of global surface waters and associated risk to aquatic invertebrates: a review. *Environ Int*. 74:291-303.
- Mosa, K.A., Gairola, S., Jamdade, R. El-Keblawy, A., Al Shaer, K.I., Al Harthi, E.K., Shabana, H.A. & Mahmoud, T. 2019. The Promise of Molecular and Genomic Techniques for Biodiversity Research and DNA Barcoding of the Arabian Peninsula Flora. *Front. Plant Sci*. 2019, 9.
- Mu, X.C., Zhang, W., Wang, L.X., Zhang, S., Zhang, K., Gao, C.F. & Wu, S.F., 2016. Resistance monitoring and *cross-resistance* patterns of three rice planthoppers, *Nilaparvata lugens*, *Sogatella furcifera* and *Laodelphax striatellus* to dinotefuran in China. *Pesticide Biochemistry and Physiology*, 134, pp.8-13.
- Mun, J.H., Song, Y.H., Heong, K.L. & Roderick, G.K., 1999. Genetic variation among Asian populations of rice planthoppers, *Nilaparvata lugens* and *Sogatella furcifera* (Hemiptera: Delphacidae): mitochondrial DNA sequences. *Bulletin of Entomological Research*, 89(3), pp.245-253.

- Nei, M. & Kumar, S., 2000. Molecular evolution and phylogenetics. Oxford university press.
- Nguyen, V.G.N., T.T. Vo, H.X. Huyn & A. Drogoul. 2011. On weather affecting to brown planthopper invasion using an agent-based model. Di dalam: Proceedings of Conference: MEDES '11: International ACM Conference on Management of Emergent Digital EcoSystems, (San Fransisco, 21–24 November 2011) hlm. 150–157. New York: ACM Proceedings.
- Pang, R., Li, S., Chen, W., Yuan, L., Xiao, H., Xing, K., Li, Y., Zhang, Z., He, X. & Zhang, W., 2023. Insecticide resistance reduces the profitability of insect-resistant rice cultivars. *Journal of Advanced Research*.
- Pang, R., M. Chen, Z. Liang, X. Yue, H. Ge & W. Zhang. 2016. Functional analysis of CYP6ER1, a P450 gene associated with imidacloprid resistance in *Nilaparvata lugens*. *Scientific Reports*. 6: 34992.
- Piyaphongkul, J., J. Pritchard & J. Bale. 2012. Can tropical insect stand the heat? A case study with the brown planthopper *Nilaparvata lugens* (Stal). *PLoS ONE*. 7 (1): e29409.
- POPT. 2019. Laporan Kinerja BBPOPT Tahun 2019. Direktorat Jenderal Tanaman Pangan. Kementerian Pertanian.
- Pramesty, A., Wisanggeni, C., Ramdhani, M. Z., Deden, D., & Dukat, D. 2023. The Effect of Insecticide Concentration of The Active Ingredient Mixture Nitenpiram+ Pimetrozin on The Intensity of Attacks by Brown Stem Planthoppers (*Nilaparvata lugens*) on Rice Plants (*Oriza sativa* L) Inpari 32 Cultivars. *Devotion: Journal of Research and Community Service*. 4(10): 2049-2057.
- Preetha, G., Stanley, J., Suresh, S. & Samiyappan, R. 2010. Risk assessment of insecticides used in rice on miridbug, *Cyrtorhinus lividipennis* Reuter, the important predator of brown planthopper, *Nilaparvata lugens* (Stal.). *Chemosphere*, 80(5): 498-503.
- Prihandiani, A., Bella, D.R., Chairani, N.R., Winarto, Y. & Fox, J. 2021. The tsunami of pesticide use for rice production on Java and its consequences. *The Asia Pacific Journal of Anthropology*: 22(4): 276-297.
- Puinean, A. M., I. Denholm, N. S. Millar, R. Nauen & M. S. Williamson. 2010. Characterisation of imidacloprid resistance mechanisms in the brown planthopper, *Nilaparvata lugens* Stal (Hemiptera: Delphacidae). *Pestic. Biochem. Physiol.* 97: 129–132.
- Pusat Data dan Sistem Informasi Pertanian Kementerian Pertanian. 2023. Analisis Komoditas Pangan Strategis Tahun 2023.
- Pusat Data dan Sistem Informasi Pertanian Kementerian Pertanian. 2023. Statistik Iklim, Organisme Pengganggu Tanaman, dan Dampak Perubahan Iklim 2020-2023.

- Putri, Z.S., Sato, T. & Yamamuro, M., 2023. Neonicotinoid occurrence and its potential toxicity level in tropical environmental waters of Indonesia. *Limnology*, pp.1-11.
- Putri, Z.S., Yusrum, A. & Yamamuro, M. 2022. Neonicotinoid contamination in tropical estuarine waters of Indonesia. *Heliyon*: 8(8).
- Reissig WH, Heinrichs EA, Litsinger JA, Moody K, Fiedler L, Mew TW & Barrion AT. 1986. Illustrated guide to integrated pest management in rice in tropical Asia. Manila (Philippines): International Rice Research Institute. 411 p.
- Roderick, G.K., 1996. Geographic structure of insect populations: gene flow, phylogeography, and their uses. *Annual review of entomology*. 41(1): 325-352.
- Roush RT & Miller GL. 1986. Considerations for design of insecticide resistance monitoring programs. *J. Econ. Entomol.* 79: 293-298.
- Roush, R.T. 1989. Designing resistance management programs: how can you choose. *Pesticide Science*. 26: 423-441.
- Saleem, M. A., M. Ahmad, M. Ahmad, M. Aslam & A.H. Sayyed. 2008. Resistance to selected organochlorine, organophosphate, carbamate and pyrethroid, in *Spodoptera litura* (Lepidoptera: Noctuidae) from Pakistan. *Journal of Economic Entomology*. 101: 1667–1675.
- Sanada-Morimura, S., Fujii, T., Chien, H. V., Cuong, L. Q., Estoy Jr, G. F., & Matsumura, M. 2019. Selection for imidacloprid resistance and mode of inheritance in the brown planthopper, *Nilaparvata lugens*. *Pest management science*. 75(8): 2271-2277.
- Sayyed, A.H., Attique, M.N.R., Khaliq, A. & Wright, D.J., 2005. Inheritance of resistance and cross-resistance to deltamethrin in *Plutella xylostella* (Lepidoptera: Plutellidae) from Pakistan. *Pest Management Science: formerly Pesticide Science*. 61(7): 636-642.
- Scott, J.G. 1999. Cytochromes P450 and insecticide resistance. *Insect Biochemistry and Molecular Biology*. 29: 757-777.
- Shafi, N., J. Ayub, N. Ashraf, A. Mian & I.U. Malik. 2016. Genetic diversity in different populations of mahseer (*Tor putitora*) in Pakistan: A RAPD based study. *International Journal of Agriculture & Biology*. 18: 1181–1187.
- Sharma, D., Singh, M.P., Vimal, D., Kumar, S., Jha, R.R. & Chowdhuri, D.K. 2018. Benzene induced resistance in exposed *Drosophila melanogaster*: Outcome of improved detoxification and gene modulation. *Chemosphere*, 201, pp.144-158.
- Simon, C., Frati, F., Beckenbach, A., Crespi, B., Liu, H. & Flook, P., 1994. Evolution, weighting, and phylogenetic utility of mitochondrial gene sequences and a compilation of conserved polymerase chain reaction primers. *Annals of the entomological Society of America*. 87(6): 651-701.

- Sofyan, D.A., Y. Koesmaryono & R. Hidayati. 2019. Analisis pengaruh faktor cuaca terhadap dinamika populasi wereng batang coklat (*Nilaparvata lugens* Stal) yang tertangkap lampu perangkap. *Jurnal Entomologi Indonesia*. 16(1): 1-8.
- Sogawa, K. & Cheng, C.H., 1979. Economic thresholds, nature of damage, and losses caused by the brown planthopper. *Brown planthopper: Threat to rice production in Asia*, pp.125-142.
- Sosa-Gomez, D.R., K.E. Delpin, A.M. Almeida & E. Hirose. 2004. Genetic differentiation among Brazilian populations of *Euschistus heros* (Fabricius) (Heteroptera: Pentatomidae) based on RAPD analysis. *Neotropical Entomology*. 33: 1–13.
- Sparks, T.C. 2013. Insecticide discovery: an evolution and analysis. *Pesticide Biochemistry Physiology*. 107: 8-17.
- Stumpf, M.P., 2004. Haplotype diversity and SNP frequency dependence in the description of genetic variation. *European journal of human genetics*, 12(6), pp.469-477.
- Sun, X. Y. Gong, S. Ali & M. Hou. 2018. Mechanisms of resistance to tiamethoxam and dinotefuran compared to imidacloprid in the brown planthopper: roles of cytochrome P450 monooxygenase and a P450 gene CYP6ER1. *Pesticide Biochemistry and Physiology*. 150: 17-26.
- Supartha, I.W., Susila, I.W., Sumiartha, I.K., Rauf, A., Cruz, L.B.D.C., Yudha, I.K.W., Utama, I.W.E.K. & Wiradana, P.A. 2022. Preference, Population Development, and Molecular Characteristics of Spodoptera Exigua (Lepidoptera: Noctuidae) on Shallot Cultivars: A Field Trial Scale. *Biodiversitas J. Biol. Divers*. 23.
- Supriyadi & R. Wijayanti. 2018. Kemiripan genetik wereng cokelat, *Nilaparvata lugens* Stal. (Homoptera: Delphacidae) populasi Klaten dan Yogyakarta berdasarkan penanda RAPD-PCR. *Jurnal Entomologi Indonesia*. 15(2): 85-92.
- Surahmat, E.C., Dadang & D. Prijono. 2016. Kerentanan Wereng Batang Cokelat (*Nilaparvata lugens*) dari enam lokasi di pulau Jawa terhadap tiga jenis insektisida. *Jurnal HPT Tropika*. 16 (1): 71-81.
- Syahrawati M, Putra OA, Rusli R & Sulyanti E. 2019. Population structure of brown planthopper (*Nilaparvata lugens*, Hemiptera: Delphacidae) and attack level in endemic area of Padang city, Indonesia. *Asian Journal of Agriculture and Biology*. Special Issue:271–276.
- Tajima, F. 1989. Statistical method for testing the neutral mutation hypothesis by DNA polymorphism. *Genetics*. 123(3): 585-595.
- Tamura K. 1992. Estimation of the number of nucleotide substitutions when there are strong transition-transversion and G + C-content biases. *Molecular Biology and Evolution* 9:678-687.

- Tamura K., Nei M., & Kumar S. 2004. Prospects for inferring very large phylogenies by using the neighbor-joining method. *Proceedings of the National Academy of Sciences (USA)* 101:11030-11035.
- Triwidodo, H. 2020. Brown planthoppers infestations and insecticides use pattern in Java, Indonesia. *AGRIVITA, Journal of Agricultural Science*, 42(2), pp.320-330.
- Triwidodo, H., Istiaji, B., Efriani, N. F., Retnowati, L., & Amanatillah, N. E. (2023). Rapid assessments of the rice brown planthopper (*Nilaparvata lugens* Stål) *outbreak* in Semarang District, Central Java: Effects of farmers' low KAP: Belajar dari kajian cepat ledakan wereng coklat (*Nilaparvata lugens* Stål) di Kabupaten Semarang, Jawa Tengah: Pengaruh dari rendahnya PST petani. *Jurnal Entomologi Indonesia*. 20(2):173-173.
- Triwidodo, Hermanu. 2021. Brown Planthopper infestation and insecticides use pattern in Java, Indonesia. *Agrivita Journal of Agricultural Science*. 42(2): 320-330.
- Tyagi, S., Narayana, S., Singh, R.N., Srivastava, C.P., Twinkle, S., Das, S.K. & Jeer, M., 2022. Migratory behaviour of Brown planthopper, *Nilaparvata lugens* (Stål)(Hemiptera: Delphacidae), in India as inferred from genetic diversity and reverse trajectory analysis. *3 Biotech*, 12(10), p.266.
- Uddin, A.B.M.A., Islam, K.S., Jahan, M., Ara, A. & Afrin, S., 2019. Farmers Perception about Resurgence of Brown Planthopper, *Nilaparvata Lugens* (Stål) in Bangladesh. *Bangladesh Rice Journal*. 23(1): 21-33.
- Utami, R.R., Geerling, G.W., Salami, I.R., Notodarmojo, S. & Ragas, A.M., 2020. Agricultural pesticide use in the upper Citarum river basin: Basic data for model-based risk management. *Journal of Environmental Science and Sustainable Development*. 3(2): 235-260.
- Wang, Y.H., C.F. Gao, Y.C. Zhu, J. Chen, W.H. Li, Y.L. Zhuang, D.J. Dai, W.J. Zhou, C.Y. Ma & J.L. Shen. 2008. Imidacloprid susceptibility survey and selection risk assessment in field population of *Nilaparvata lugens*. *Journal of Economic Entomology*. 101: 515-522.
- Wang, Y.H., S.G. Wu, Y.C. Zhu, J. Chen, F.Y. Liu, X.P. Zhao, Q. Wang, Z. Li, X.P. Bo & J.N. Shen. 2009. Dynamics of imidacloprid resistance and *cross-resistance* in the brown planthopper, *Nilaparvata lugens*. *Entomologia Experimentalis et Applicata*. 131: 20–29.
- Wei, S.J., Shi, B.C., Gong, Y.J., Jin, G.H., Chen, X.X. & Meng, X.F., 2013. Genetic structure and demographic history reveal migration of the diamondback moth *Plutella xylostella* (Lepidoptera: Plutellidae) from the southern to northern regions of China. *PloS one*, 8(4), p.e59654.
- Wen, Y., Liu, Z., Bao, H. & Han, Z., 2009. Imidacloprid resistance and its mechanisms in field populations of brown planthopper, *Nilaparvata lugens* Stål in China. *Pesticide Biochemistry and Physiology* 94(1): 36-42.

- Winnie, R. M., Raffiudin, R., Widiarta, I. N., & Rauf, A. (2020). The genetic structure of *Nilaparvata lugens* (Stal.) in Java populations. *HAYATI Journal of Biosciences*, 27(4), 330-330.
- Wu, S., He, M., Xia, F., Zhao, X., Liao, X., Li, R. & Li, M., 2022. The *cross-resistance* pattern and the metabolic resistance mechanism of acetamiprid in the brown planthopper, *Nilaparvata lugens* (Stål). *International Journal of Molecular Sciences*, 23(16), p.9429.
- Wu, S.F., B. Zeng, C. Zheng, X.C. Mu, Y. Zhang, J. Hu, S. Zhang, C.F. Gao & J.L. Shen. 2018. The evolution of insecticide resistance in the brown planthopper (*Nilaparvata lugens*) of China in the period 2012-2016. *Scientific Report*. 8: 4586.
- Xue, J., X. Zhou & C.X. Zhang. 2014. Genomes of the rice pest brown planthopper and its endosymbionts reveal complex complementary contributions for host adaptation. *Genome Biology*. 15: 521.
- Yang, N., Xie, W., Jones, C.M., Bass, C., Jiao, X., Yang, X., Liu, B., Li, R. & Zhang, Y., 2013. Transcriptome profiling of the whitefly *Bemisia tabaci* reveals stage-specific gene expression signatures for thiamethoxam resistance. *Insect molecular biology*. 22(5): pp.485-496.
- Yang, Q., Zhou, D., Sun, L., Zhang, D., Qian, J., Xiong, C., Sun, Y., Ma, L. & Zhu, C., 2008. Expression and characterization of two pesticide resistance-associated serine protease genes (NYD-tr and NYD-ch) from *Culex pipiens pallens* for metabolism of deltamethrin. *Parasitology research*. 103: 507-516.
- Yang, S.J., Bao, Y.X., Zheng, X.F. & Zeng, J., 2022. Effect of the Asian monsoon on the northward migration of the brown planthopper to northern South China. *Ecosphere*. 13(10): e4217.
- Yang, Y., Huang, L., Wang, Y., Zhang, Y., Fang, S. & Liu, Z. 2016. No *cross-resistance* between imidacloprid and pymetrozine in the brown planthopper: status and mechanisms. *Pesticide Biochemistry and Physiology*. 130: 79-83.
- Yanuwiadi, B., & Grahadi, R. 2022. Genetic Differentiation of Brown Planthopper *Nilaparvata lugens* (Stål) Populations in Asia: Genetic Differentiation of Brown Planthopper in Asia. *Journal of Tropical Life Science*. 12(2): 282-288.
- Yu, N., Tian, J., Zhang, Y., Li, Z., & Liu, Z. (2018). Imidacloprid-susceptible *Nilaparvata lugens* individuals exceeded resistant individuals in a mixture population with density pressure. *Pest management science*, 74(1): 234-239.
- Zewen, L., Zhaojun, H., Yinchang, W., Lingchun, Z., Hongwei, Z., & Chengjun, L. (2003). Selection for imidacloprid resistance in *Nilaparvata lugens*: cross-resistance patterns and possible mechanisms. *Pest Management Science: formerly Pesticide Science*, 59(12): 1355-1359.

- Zhang, H., J. Zou, B. Yang, Y. Zhang & Z. Liu. 2023. Importance of CYP6ER1 was different among neonicotinoids in their susceptibility in *Nilaparvata lugens*. *J. Agric. Food Chem.* 71: 4163-4171.
- Zhang, J., Zhang, Y., Wang, Y., Yang, Y., Cang, X. & Liu, Z. 2016b. Expression induction of P450 genes by imidacloprid in *Nilaparvata lugens*: a genome-scale analysis. *Pestic. Biochem. Physiol.* 132, 59e64.
- Zhang, W., Liu, Y. & Bell, A., 2018. Disentangling determinants of insecticide use to manage production, food security, and health risks in Cambodia and Vietnam: evidence from household surveys and risk-assessment experiments. *The Lancet Planetary Health*, 2, p.S11.
- Zhang, X., Liao, X., Mao, K., Zhang, K., Wan, H. & Li, J., 2016a. Insecticide resistance monitoring and correlation analysis of insecticides in field populations of the brown planthopper *Nilaparvata lugens* (Stål) in China 2012–2014. *Pesticide Biochemistry and Physiology*. 132:13-20.
- Zhang, X., Liu, X., Zhu, F., Li, J., You, H. & Lu, P., 2014. Field evolution of insecticide resistance in the brown planthopper (*Nilaparvata lugens* Stål) in China. *Crop Protection*. 58:61-66.
- Zhang, Y., Y. Yang, H. Sun & Z. Liu. 2016. Metabolic imidacloprid resistance in the brown planthopper, *Nilaparvata lugens*, relies on multiple P450 enzymes. *Insect Biochemistry and Molecular Biology*. 79: 50–56.
- Zhao, K.F., Shi, Z.P. & Wu, J.C., 2011. Insecticide-induced enhancement of flight capacity of the brown planthopper *Nilaparvata lugens* Stål (Hemiptera: Delphacidae). *Crop Protection*, 30(4), pp.476-482.
- Zimmer, C.T., Garrood, W.T., Singh, K.S., Randall, E., Lueke, B., Gutbrod, O., Matthiesen, S., Kohler, M., Nauen, R., Davies, T.E. & Bass, C., 2018. Neofunctionalization of duplicated P450 genes drives the evolution of insecticide resistance in the brown planthopper. *Current Biology*, 28(2): 268-274.