UNIVERSITAS GADJAH MADA
Pengaruh Jagung Transgenik Cry1Ab terhadap Hama Non-targe Spodoptera frugiperda di Kapanewon Tempel, Sleman
Jambunada Prabhasvara, Prof. Ir. Y. Andi Trisyono, M.Sc., Ph.D.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Badan Pusat Statistik, 2025. https://www.bps.go.id/id/statistics-table/2/MjIwNCMy/luas-panen--produksi--dan-produktivitas-jagung-menurut-provinsi.html. Di akses pada tanggal 10 Oktober 2025.

Balai Besar Peramalan Organisme Pengganggu Tumbuhan. 2025. Prakiraan Serangan OPT Utama Padi, Jagung, Kedelai, Aneka Kacang, dan Umbi di Indonesia MT 2025.

Botha, A. S., A. Erasmus., H. du Plessis, and J. Van den Berg. 2019. Efficacy of Bt maize for control of *Spodoptera frugiperda* Lepidoptera: Noctuidae in South Africa. Journal of Economic Entomology, 112(3): 1260-1266. https://doi.org/10.1093/jee/toz048.

Carzoli, A. K., S. I. Aboobucker., L. L. Sandall., T. T. Lübberstedt, and W. P. Suza. 2018. Risks and opportunities of GM crops: Bt maize example. Global Food Security, 19(1): 84-91. https://doi.org/10.1016/j.gfs.2018.10.004.

Davis F, and W. Williams. 1992. Visual Rating Scales for Screening Whorl-Stage Corn for Resistance to Fall armyworm. Technical Bulletin 186. Mississippi State University, MS39762, USA. https://www.cabidigitallibrary.org/doi/full/10.5555/19931170718.

Direktorat Perlindungan Tanaman Pangan. 2020. Pedoman Operasional Pengamatan dan Pengendalian *Spodoptera frugiperda* pada Jagung. Direktorat Jenderal Tanaman Pangan, Kementerian Pertanian, Jakarta.

Dively, G. P., T. P. Kuhar., S. Taylor., H. B. Doughty., K. Holmstrom., D. Gilrein, and K. A. Hamby. 2021. Sweet corn sentinel monitoring for Lepidopteran field-evolved resistance to Bt toxins. Journal of Economic Entomology, 114(1): 307-319. https://doi.org/10.1093/jee/toaa264.

Djunaedy, A., S. Khoiri., D. F. H. Azari., Z. Syamsiyah., G. Pawana., D. Megasari, and G. Giyanto. 2024. Development of *Bacillus thuringiensis*-based liquid and paste formulations for controlling invasive pest species *Spodoptera frugiperda* JE Smith. Jurnal Hama dan Penyakit Tumbuhan Tropika, 24(2): 154-161. https://doi.org/10.23960/jhptt.224154-161.

EFSA Panel on Genetically Modified Organisms. 2009. Scientific Opinion on application (EFSA-GMO-UK-2007-49) for the placing on the market of the insect resistant and herbicide tolerant genetically modified maize Bt11xGA21 for food and feed uses, import and processing under Regulation (EC) No 1829/2003 from Syngenta Seeds. EFSA Journal, 7(9): 13-19. https://doi.org/10.2903/j.efsa.2009.1319.

Gomez, I., J. Ocelotl., J. Sanchez., C. Lima., E. Martins., A. Rosales-Juarez, and M. Soberon. 2018. Enhancement of *Bacillus thuringiensis* Cry1Ab and Cry1Fa toxicity to *Spodoptera frugiperda* by domain III mutations indicates there are two limiting steps in toxicity as defined by receptor binding and protein stability. Applied and Environmental Microbiology, 84(20): 13-18. https://doi.org/10.1128/AEM.01393-18.

He, L. M., S. Y. Zhao., X. W. Gao, and K. M. Wu. 2021. Ovipositional responses of *Spodoptera frugiperda* on host plants provide a basis for using Bt-transgenic maize as trap crop in China. Journal of Integrative Agriculture, 20(3): 804-814. https://doi.org/10.1016/S2095-3119(20)63334-2.

UNIVERSITAS
GADJAH MADA
Pengaruh Jagung Transgenik Cry1Ab terhadap Hama Non-targe Spodoptera frugiperda di Kapanewon Tempel, Sleman
Jambunada Prabhasvara, Prof. Ir. Y. Andi Trisyono, M.Sc., Ph.D.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

He, Y., K. Wang., G. Du., Q. Zhang., B. Li., L. Zhao, and B. Chen. 2022. Temporal and spatial distribution patterns of *Spodoptera frugiperda* in mountain maize fields in China. Insects, 13(10): 938. https://doi.org/10.3390/insects13100938.

Hernandez-Rodriguez, C. S., P. Hernandez-Martinez., J. Van Rie., B. Escriche, and J. Ferre. 2013. Shared midgut binding sites for Cry1A. 105, Cry1Aa, Cry1Ab, Cry1Ac and Cry1Fa proteins from *Bacillus thuringiensis* in two important corn pests, *Ostrinia nubilalis* and *Spodoptera frugiperda*. PloS One, 8(7): 68-164. https://doi.org/10.1371/journal.pone.0068164.

Higo, Y., M. Sasaki, and T. Amano. 2022. Morphological characteristics to identify fall armyworm, *Spodoptera frugiperda* Lepidoptera Noctuidae from common polyphagous noctuid pests for all instar larvae in Japan. Applied Entomology and Zoology, 57(3): 263-274. https://doi.org/10.1007/s13355-022-00781-x.

Hodgson, E. W., A. N. Dean, and M. E. Rice. 2024. Recognizing feeding injury to corn ears in the United States. Journal of Integrated Pest Management, 15(1): 18. https://doi.org/10.1093/jipm/pmae009.

Hoöfte, H, and H. Whiteley. 1989. Insecticidal crystal proteins of *Bacillus thuringiensis*. Microbiological reviews, 53(2): 242-255. https://doi.org/10.1128/mr.53.2.242-255.1989.

Jurat-Fuentes, J. L, and N. Crickmore. 2017. Specificity determinants for Cry insecticidal proteins Insights from their mode of action. Journal of Invertebrate Pathology, 14(2): 5-10. https://doi.org/10.1016/j.jip.2016.07.018.

Karundeng, A., J. M. E. Mamahit, and D. S. Kandowangko. 2024. Predators and parasitoids species Of *Spodoptera frugiperda* JE Smith on corn plant in North Minahasa regency. Jurnal Agroekoteknologi Terapan, 5(1): 6-12. https://doi.org/10.35791/jat.v5i1.46261.

Kasige, R. H., C. D. Dangalle., N. Pallewatta, and M. T. M. D. R. Perera. 2022. Egg cluster characteristics of fall armyworm, *Spodoptera frugiperda* Lepidoptera: Noctuidea in Sri Lanka under laboratory conditions. Journal of Agricultural Sciences Sri Lanka, 17(1): 5-12. http://doi.org/10.4038/jas.v17i1.9620.

Kementerian Pertanian Republik Indonesia. (2023). Keputusan Menteri Pertanian Nomor 104/KPTS/PV.240/M/03/2023 tentang pelepasan varietas jagung NK6172-Bt11xGA21 sebagai varietas unggul tanaman jagung hibrida produk rekayasa genetik. Tersedia pada: https://indonesiabch.kemenlh.go.id/wp-content/uploads/2023/08/PRG-3-PT-SYNGENTA-JGG-NK6172-Bt11xGA21.pdf.

Kennedy, G. G. 2008. Integration of insect-resistant genetically modified crops within IPM programs. Integration of insect-resistant genetically modified crops within IPM programs, 10(3): 1-26. https://doi.org/10.1007/978-1-4020-6359-6.

Li, G., H. Feng., T. Ji., J. Huang, and C. Tian. 2021. What type of Bt corn is suitable for a region with diverse Lepidopteran pests: A laboratory evaluation. GM Crops and Food, 12(1): 115-124. https://doi.org/10.1080/21645698.2020.1831728.

Li, X. J., J. Wu., X. C. Dai., Y. Q. Wang., R. F. Wang., Z. X. Zhang, and H. H. Xu.

UNIVERSITAS GADJAH MADA
Pengaruh Jagung Transgenik Cry1Ab terhadap Hama Non-targe Spodoptera frugiperda di Kapanewon Tempel, Sleman
Jambunada Prabhasvara, Prof. Ir. Y. Andi Trisyono, M.Sc., Ph.D.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

2021. Study on the damage of *Spodoptera frugiperda* to ears of different maize cultivars. https://www.cabidigitallibrary.org/doi/full/10.5555/20220432184.

Niinemets, U. U., R. K. Monson., A. Arneth., P. Ciccioli., J. Kesselmeier., U. Kuhn, and M. Staudt. 2010. The emission factor of volatile isoprenoids: caveats, model algorithms, response shapes and scaling, 7(2): 1233-1293. http://dx.doi.org/10.5194/bgd-7-1233-2010.

Omoto, C., O. Bernardi., E. Salmeron., R. J. Sorgatto., P. M. Dourado., A. Crivellari, and G. P. Head. 2016. Field-evolved resistance to Cry1Ab maize by *Spodoptera frugiperda* in Brazil. Pest management science, 72(9): 1727-1736. https://doi.org/10.1002/ps.4201.

Pathak, R., U. Chandra, and P. K. Patel. 2024. Life cycle and morphometric analysis of fall armyworm, *Spodoptera frugiperda* J.E. Smith Lepidoptera: Noctuidae on *Zea mays*, 8(10): 580-583. https://doi.org/10.33545/26174693.2024.v8.i10Sg.2534.

Prada, D. A. G., J. R. Chalarca, and S. J. V. Catanño. 2018. Identification of Lepidoptera Larval Stages A Maize Pest. International Center for Tropical Agriculture, Colombia.

Reisig, D. D, and F. P. Reay-Jones. 2015. Inhibition of *Helicoverpa* zea Lepidoptera growth by transgenic cornexpressing Bt toxins and development of resistance to Cry1Ab. Environmental Entomology, 44(4): 1275-1285. https://doi.org/10.1093/ee/nvv076.

Rojas, J. C., A. Virgen, and E. A. Malo. 2004. Seasonal and nocturnal flight activity of *Spodoptera frugiperda* males Lepidoptera : Noctuidae monitored by pheromone traps in the coast of Chiapas, Mexico. Florida Entomologist, 87(4): 496-503. https://doi.org/10.1653/0015 4040(2004)087[0496:SANFAO]2.0.CO;2.

Romeis, J., M. Meissle., S. E. Naranjo., Y. Li, and F. Bigler. 2014. The end of a myth-Bt Cry1Ab maize does not harm green lacewings. Frontiers in Plant Science, 5(1): 330-391.https://doi.org/10.3389/fpls.2014.0039.

Sousa, F. F., S. M. Mendes., O. F. Santos-Amaya., O. G. Araújo., E. E. Oliveira, and E. J. Pereira. 2016. Life-history traits of *Spodoptera frugiperda* populations exposed to low-dose Bt maize. PloS One, 11(5): 15-66. https://doi.org/10.1371/journal.pone.0156608.

Tabashnik, B. E., M. Zhang., J.A. Fabrick., Y. Wu., M. Gao., F. Huang., J. Wei., J. Zhang., A. Yelich., G.C. Unnithan., A. Bravo., M. Soberón., Y. Carrière, and X. Li. 2015. Dual mode of action of *Bt* proteins: protoxin efficacy against resistant insects. Scientific reports, 5(1): 15-107. https://doi.org/10.1038/srep15107.

Trisyono, Y. A., H. N. Hendrayanti., A. P. Yuantomoputro., A. V. Setyaningrum., S. Harjanto, and V. E. Aryuwandari. 2024. An update on the fall armyworm: severity of maize damage and susceptibility to emamectin benzoate and chlorantraniliprole. JurnalPerlindungan Tanaman Indonesia, 28(2): 134-140. https://doi.org/10.22146/jpti.95262.

Trisyono, Y. A., Suputa., V. E. F. Aryuwandari., M. Hartaman, and Jumari. 2019. Occurrence of heavy infestation by the fall armyworm *Spodoptera frugiperda*, a new alien invasive pest, in corn in Lampung Indonesia, 23(1): 156-160. https://doi.org/10.22146/jpti.46455.

UNIVERSITAS
GADJAH MADA
Pengaruh Jagung Transgenik Cry1Ab terhadap Hama Non-targe Spodoptera frugiperda di Kapanewon Tempel, Sleman
Jambunada Prabhasvara, Prof. Ir. Y. Andi Trisyono, M.Sc., Ph.D.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Wang, J., J. Wei., T. Yi., Y. Y. Li., T. Xu., L. Chen, and H. Xu. 2023. A green leaf volatile, (Z)-3-hexenyl-acetate, mediates differential oviposition by *Spodoptera frugiperda* on maize and rice. BMC biology, 21(1): 140-155. https://doi.org/10.1186/s12915-023-01642-x.