

- Adjaloo, M. K., and Oduro, W. 2013. Insect Assemblage and the Pollination System in Cocoa Ecosystems. *Journal of Applied Biosciences*. 62 (1): 4582-4594.
- Albachew, G. W. 2018. Economic value of pollination service of agricultural crops in Ethiopia: biological polinators. *Journal Apic Sci*. 62 (2): 265-273.
- Ambele, C. F., Bisseleua, H. D. B., Djuideu, C. T. L., Akutse, K. S. 2023. Managing Insect Services and Disservices in Cocoa Agroforestry Systems. *Agroforestry Systems*. 97 (6): 965–84.
- Anin, F. K., Adjaloo, M. K., Kwapong, P. K. Oduro, W. 2014. Structure and Stability of Cocoa Flowers and Their Response to Pollination. *Journal of Botany*. 1: 1-7.
- Anin, F. K., Bosu. P. P. Adjaloo, M. K. Braimah, H. Oduro, W. Kwapong. P. 2015. *Some Facts about Cocoa Pollination*. University of Cape Coast Printing Press. Ghana.
- Basualdo, M., P., Cavigliasso, R., De Avila Jr, S., Sanchez, P. I., Benítez, A. C., Harms, J. M., Ramos, A. K., Bravo, V. R., Salvarrey, S. 2022. Current status and economic value of insect-pollinated dependent crops in Latin America. *Ecological Economic*. 196: 1-10.
- Bhattacharjee, R., Akoroda, M. 2018. *Taxonomy and Classification of Cacao*. Burleigh Dodds Science Publishing. Cambridge. Pp. 5.
- Borkent, A., Coetzee, M., Cumming, J. M., Harris, K. M, Jackson, M.D., Kirk-Spriggs, A. H., Mansell, M. W., Marshall, S. A., McGavin, G. C., McGregor, G. K. 2017. *Manual of Afrotropical Diptera*. Kirk-Spriggs AH, Sinclair BJ, editor. Pretoria: South African National Biodiversity Institute (SANBI).
- Bos, M. M., Steffan-Dewenter, I., Tscharnkte, T. 2007. Shade Tree Management Affects Fruit Abortion, Insect Pests and Pathogens of Cacao. *Agriculture, Ecosystems and Environment*. 120 (4): 201–5.
- Bravo, M, Somarriba, E., Arteaga, G., 2011. Factors affecting the abundance of cocoa pollinating midges in agroforestry systems. *Revista de Ciencias Agrícolas*. 28: 119–131.
- Chavez, E. S., Bustillos. R. C., Chaverri. C. A. D. F. Q., Morer, N. V., Aguilar, L. O. 2010. *Reproduction of Cacao*. CATIE, Costa Rica.
- Christian, W., Gottsberger, G. 2000. Diversity Prey in Crop Pollination. *Crop Science*. 40(5): 1209–22.
- Chumacero de Schawe, C. C., Durka, W. Tscharnkte, T., Hensen, I., and Kessler, M. 2013. Gene Flow and Genetic Diversity in Cultivated and Wild Cacao (*Theobroma Cacao* L.) in Bolivia. *American Journal of Botany*. 100(11): 2271–2279.
- Cruz, A. F., Suwastika. I. N., Sasaki, H. Uchiyama, T. Pakawaru, N. A, Wijayanti, W. Muslimin, Basri, Z., Ishizaki, Y., Shiina, T. 2019. Cacao Plantations on Sulawesi Island, Indonesia: I—an Agro-Ecological Analysis of Conventional and Organic Farms. *Organic Agriculture*. 9(2): 225–34.
- Davit, J., Yusuf, R. P., Yurandi, D. A. 2013. Pengaruh Cara Pengolahan Kakao Fermentasi dan Non Fermentasi Terhadap Kualitas, Harga Jual Produk pada Unit Usaha Produktif (UUP) Tunjung Sari, Kabupaten Tabanan. *E-Jurnal Agribisnis dan Agrowisata*. 2 (4): 191-203.



- Donald, P.F., 2004. Biodiversity impacts of some agricultural commodity production systems. *Conservation Biology*. 18(1): 17–38.
- Duan. C., Xiao. H. J., Xiao Jing. H., Xiao Hui. H. Description of a New Species of *Forcipomyia* (*Forcipomyia*) (Diptera: Ceratopogonidae) and a Key to Species of the Subgenus From the Chinese Mainland. *Journal of Medical Entomology*. 20 (10).
- Ellstrand, N. C. 1992. Gene Flow by Pollen : Implications for Plant Conservation Genetics. *Oikos*. 63(1):77–86.
- Entwistle, P. F. 1972. *Pests of Cocoa*. First Edition. Longman, London
- Even. N., Olivier. B., Mathieu. L. 2020. *Navigation by honey bee*. Encyclopedia of Animal Cognition and Behavior. Springer Cham: USA.
- Fahmid, I. M., Harun, H., Fahmid, M. M., Saadah, and Busthanul, N. 2018. Competitiveness, Production, and Productivity of Cocoa in Indonesia.” *IOP Conference Series: Earth and Environmental Science*. 157(1): 1-6.
- Falque, M., Vincent, A., Vaissiere, B.E., Eskes, A.B., 1995. Effect of pollination intensity on fruit and seed set in cacao (*Theobroma cacao* L.). *Sexual Plant Reproduction*. 8(6): 354–360.
- FAO. 2015. *Statistical Pocket Book 2015 World Food and Agriculture* (Rome: Food and Agriculture Organization of United Nations). Pp. 236.
- FAO. 2017. Food and Agriculture Organization of the United Nations. <https://www.fao.org/>
- FAO. 2018. *Why Bees Matter The Importance of Bees and Other Polinators for Food and Agriculture*.
- Ford, C. S., M. J. Wilkinson. 2012. Confocal observations of late-acting self-incompatibility in *Theobroma cacao* L. *Sexual Plant Reproduction*. 25(3): 169–183.
- Frimpong, E. A., Gordon, I., P. K. Kwapong., Herren, B. G. 2009. Dynamics of Cocoa Pollination: Tools and Applications for Surveying and Monitoring Cocoa Polinators. *International Journal of Tropical Insect Science*. 29(2):62–69.
- Gallai, N., Salles, J.M., Settele, J., Vaissière, B. E. 2009. Economic Valuation of the Vulnerability of World Agriculture Confronted with Polinator Decline. *Ecological Economics*. 68(3):810–21.
- Garibaldi, L. A., Carvalheiro, L. G., Vaissière, B. E., Gemmill-herren, B., Hipólito, J., Freitas, B. M., Ngo, H. T. Azzu. N., Sáez, A. Åström, J., Jiandong A., Blochtein, B. 2016. Mutually beneficial polinator diversity and crop yield outcomes in small and large farms. *Science*. 351(6271):388–91.
- Gillot, C. 2005. *Entomology Third Edition*. Netherlands: Springer
- Glendinning, D.R., 1972. Natural pollination of cocoa. *New Phytol*. 7:719–729.
- Goulet, H., Huber, J. T. 1993. *Hymenoptera of The World: An Identification Guide to Families*. Ottawa (CA). Agriculture Canada.
- Greenleaf, S., Williams, N., Winfree, R., Kremen, C. 2007. Bee foraging ranges and their relationship to body size. *Oecologia*. 153: 89–596.



- Groeneveld, J. H., Tschardtke. T., Moser, G., Clough, Y. 2010. Experimental Evidence for Stronger Cacao Yield Limitation by Pollination than by Plant Resources. *Perspectives in Plant Ecolog Evolution and Systematics*. 12(3):183–91.
- Gullan. P. J., Cranston. P. S. 2014. *The Insects: An Outline of Entomology*. fifth edition Wiley-Blackwell: Oxford.
- Gullan. P. J., P. S. Cranston. 2014. *The Insects: An Outline of Entomology*. fifth edition. Oxford: Wiley Blackwell.
- Halbritter H., Heigl H., Buchner R. 2021. *Theobroma cacao*. In: PalDat - A palynological database. https://www.paldat.org/pub/Theobroma_cacao/305202; accessed 2024-11-18.
- Halbritter, H. 1998. Preparing living pollen material for scanning electron microscopy using 2,2-dimethoxy propane (DMP) and critical point drying. *Biotechnic Histochem* 73(3): 137–143.
- Hernandez. M. T., Wanger, T. C., Tschardtke, T. 2017. Neglected polinators: Can enhanced pollination services improve cocoa yields? A review. *Agriculture, Ecosystems and Environment*. 247: 137-148.
- ICCO. 2022. Quarterly Bulletin of Cocoa Statistics No 3. Cocoa year 2021/2022, cocoa season 2020/2021. <https://www.icco.org/Statistics> - International Cocoa Organization (icco.org) [diakses 1 Desember 2023].
- Indriyani, S., G. Ekowati, W. Widoretno. 2018. *Petunjuk Parktikum Biologi Reproduksi Tumbuhan*. UB: Malang.
- Jones, G. D. 2014. Pollen analyses for pollination research, acetolysis. *Journal of Pollination Ecology*. 13(21): 203-217.
- Jumar. 2000. Entomologi Pertanian. Pt Rineka Cipta: Jakarta.
- Kaufmann, T., 1975. Studies on the ecology and biology of a cocoa polinator, *Forcipomyia squamipennis* I. And M. (Diptera, ceratopogonidae), in Ghana. *Bulleting of Entomological Research*. 65: 263–268.
- Klein, A. M., Vaissière, B. E., Cane, J.H., Dewenter, I. S., Cunningham, S. A., Kremen, C., and Tschardtke, T. 2007. Importance of Polinators in Changing Landscapes for World Crops. *Proceedings of the Royal Society B: Biological Sciences* 274 (1608): 303–313.
- Kongor, J.E., Hinneh, M., Van de Walle, D., Afoakwa, E.O., Boeckx, P., Dewettinck, K. 2016. Factors Influencing Quality Variation in Cocoa (*Theobroma Cacao*) Bean Flavour Profile - A Review. *Food Research International*. 82:44–52.
- Leksikowati, S. S., Putra, E. R., Rosmiati, M. Kinasih, I. Husna Z., Novitasari., Setiyarni, E., Rustam, F. A. 2020. Aplikasi *Trigona* (Tetragonula) *laeviceps* sebagai agen penyerbuk pada sistem tumpang sari buncis dan tomat di dalam rumah kaca. *J Sumber Hayati*. 4(2): 63–70.
- Liferdi, L. 2008. Lebah Polinator Utama Pada Tanaman Hortikultura. *IPTEK Hortikultura* .4 :1–5.
- Lopes, U.V., Monteiro, W.R., Pires, J.L., Clement, D., Yamada, M.M., Gramacho. K.P. 2011.

- Lu X, Duan C, Ning Y, Jiang XH, Hou XH. 2020. Morphology of the immature stages of *Dasyhelea silvatica* Wang, Zhang & Yu with redescrptions of adults (Diptera, Ceratopogonidae). *ZooKeys*. 961: 119–127.
- Maia-Silva. C., Hrcir. M., Giannini. T. C., Toledo-Herndez. M. and Imperatriz-Fonseca. V. L. .2024. Small Amazonian stingless bees: an opportunity for targeted cocoa pollination. *Front. Bee Sci*. 2 (1):1-19.
- Majewski. J, D. Popa, A. Sobolewska. 2021. Economic Value of Pollination of Orchards, Case of Moldova and Poland. *Rural Dev*. 21(1):479–86.
- Managanta, A. A., Sumardjo, D. Sadono, P. Tjitropranoto. 2019. Faktor-Faktor yang Berpengaruh terhadap Kompetensi Petani Kakao di Provinsi Sulawesi Tengah. *Jurnal Penyuluhan*.15 (1): 120-133.
- Mangena. P., Mokwala, P. M. 2018. *Introductory Chapter: Pollination. Pollination in Plants*. IntechOpen, London.
- MARS, 2017. Cocoa Sustainable Approach. Giving Farmers the Tools to Thrive. <http://www.mars.com/global/sustainability/rawmaterials/cocoa/sustainabilityapproach>.
- Mburu. J., L. G. Hein, L. G. 2006. *Economic Valuation of Pollination Services: Review of Methods*. Rome: University of Bonn.
- McAlpine, J.F., Peterson, B.V., Shewell, G. E., Teskey, H. J., Vockeroth, J. R., Wood, D. M. 1981. *Manual of Nearctic Diptera*. Ottawa: Research Branch Agriculture Canada
- McGregor, S. E., 1976. *Insect pollination of cultivated crop plants*. Agriculture Handbook: United States Department of Agriculture.
- Nisa, D. P. J. I. N., Darsono., Antriandarti, E. 2023. Comparative Analysis of Indonesian Cocoa Competitiveness in the International Market. *AIP Conference Proceedings* 2583.
- Nugroho. A., Atmowidi, T., Kahono, S. 2019. Diversitas Serangga Penyerbuk Dan Pembentukan Buah Tanaman Kakao (*Theobroma Cacao* L.). *Jurnal Sumberdaya Hayati*. 5 (1): 11–17.
- Omolaja, S. S., Aikpokpodion, P., Oyedeji, S., Vwioko, D. E., 2010. Rainfall and Temperature Effects on Flowering and Pollen Productions in Cocoa. *African Crop Science Journal*. 17(1): 41-48.
- Palynological Database. 2021. *Theobroma cacao*. https://www.paldat.org/pub/Theobroma_cacao/305202 [Diakses 03 Februari 2024].
- Pangestika. N. W., Tri. A., Sih. K. 2017. Pollen load and flower constancy of three species of stingless bees (Hymenoptera, Apidae, Meliponinae). *Tropical Life Sciences Research* 28(2):177–186.
- Pérez Gutiérrez GS (2013) Plan de negocios para la exportación de cacao producido en la región 7 (Loja, Zamora y El Oro) (Master's thesis).
- Price. P. W. 1997. *Insect Ecology*, 3rd Edition. John Wiley and Sons: USA.



Putra, D. P., Dahenn, S., Salsman, S., Swasti, E. 2016. Pollination in chili pepper (*Capsicum annuum* L.) by *Trigona laeviceps* and *T. minangkabau* (Hymenoptera, Meliponini). *J Entomol Zool Studies*. 4 (4): 191-194

Raguso, A. R. 2020. Don't forget the flies: dipteran diversity and its consequences for floral ecology and evolution. *Applied Entomology and Zoology*. 55:1-7.

Renner, S. S. 1993. Pollination Ecology - A Practical Approach. *Nordic Journal of Botany*. 13(5):514-514.

Resh. V., R. Carde. 2009. *Encyclopedia of Insects, Second Edition*. Academic Press: Department in Oxford, UK.

Sarwar, M. 2020. *Typical Flies: Natural History, Lifestyle and Diversity of Diptera*. IntechOpen.

Shattuck, S. O. 1999. *Australian Ants: Their Biology and Identification*. Monographs on Invertebrate Taxonomy Vol 3. Collingwood (AU). Csiro publishing.

Siefert. P, Buling. N, Gru'newald B (2021) Honey bee behaviours within the hive: Insights from long-term video analysis. *PLoS ONE* 16(3): 1-14.

Sivachandran, R., Gnanam, R. Sudhakar, Suresh, D. J., Ram, S. G. 2017. Influence of Genotypes, Stages of Microspore, Pre-Treatments and Media Factors on Induction of Callus from Anthers of Cocoa (*Theobroma Cacao* L.) Haploids Induction for Rapid Homozygosity to Accelerate Breeding Programs in Cocoa (*Theobroma Cacao* L.). *Journal of Plantation Crops*. 45 (3): 162-72.

Smith. J.P., Tim. A. H., Madelaine, B., Ros. G. 2016. Flight range of the Australian stingless bee *Tetragonula carbonaria* (Hymenoptera: Apidae). *Austral Entomology*. Vol 56 1-4.

Soerodjotanojo, S. 1996. *Membina Usaha Industri Ternak Lebah Madu Apis mellifica*. Balai Pustaka, Jakarta.

Sugiharto. 1989. *Mikroteknik*. Departemen Pendidikan dan Kebudayaan Direktorat Jendral Pendidikan Tinggi Pusat Antar Universitas Ilmu Hayat Institut Pertanian Bogor. Bogor.

Syakir, Karmawati, M. E., Pitono, J. 2012. *Teknologi Budidaya dan pascapanen kakao*. Jakarta IAAARD Press: Pusat Penelitian dan Pengembangan Perkebunan.

Szinwelski, Neucir, Fialho, S. V., Yotoko, K. S. C. Seleme, L. R., Sperber, C. F. 2012. Ethanol Fuel Improves Arthropod Capture in Pitfall Traps and Preserves DNA. *ZooKeys*. 196: 11-22.

Talledo. G. B., Bazurto, Z. A., García Cruzatty, L. 2019. Morphology, viability, and longevity of pollen of National Type and Trinitarian (CCN-51) clones of cocoa (*Theobroma cacao* L.) on the Coast of Ecuador. *Braz. J. Bot* 42(3): 441-448.

Thomas, S. G, S. M. Rehel, A. Varghese, P. Davidar, S. G. Potts. 2009. Social bees and plant associations in the Nilgiri Biosphere Reserve. *India. Trop. Ecol*. 50(1): 79- 88.

Trianto, M., & Purwanto, H. 2020. Morphological characteristics and morphometrics of stingless bees (Hymenoptera: Meliponini) in Yogyakarta, Indonesia. *Biodiversitas*, 21(6): 2619-2628.

Trianto, M., & Purwanto, H. 2022. Diversity, abundance, and distribution patterns of stingless bees (Hymenoptera: Meliponini) in Yogyakarta, Indonesia. *Biodiversitas*, 23(2): 695-702.



- Tscharntke, T., Clough, Y., Bhagwat, S. A., Buchori, D., Faust, H., Hertel, D., Hölscher, D., Juhrbandt, J., Kessler, M., Perfecto, I., Scherber, C., Schroth, G., Veldkamp, E., Wanger, T.C.. 2011. Multifunctional Shade-Tree Management in Tropical Agroforestry Landscapes - A Review. *Journal of Applied Ecology*. 48(3): 619–29.
- Valle, R.R., De Almeida, A.-A.F., De O. Leite, R.M., 1990. Energy costs of flowering, fruiting, and cherelle wilt in cacao. *Tree Physiol.* 6(3): 329–336.
- Vandromme M, Trekels H, Sepúlveda Ruiz N, Somarriba E, Vanschoenwinkel B. 2019. Exploring the suitability of bromeliads as aquatic breeding habitats for cacao pollinators. *Hydrobiologia*. 828 (1): 327–337.
- Wielgoss, A., Tscharntke, T., Rumedé, A., Fiala, B., Seidel, H., Shahabuddin, S., Clough, Y. 2013. Interaction Complexity Matters: Disentangling Services and Disservices of Ant Communities Driving Yield in Tropical Agroecosystems. *Proceedings of the Royal Society B: Biological Sciences*. 281(1775).
- Winder, J. A., 1977. Recent research on insect pollination of cocoa. *Cocoa Growers Bull.* Vol 26(2): 11–19.
- Winder, J. A., 1978. The role of non-dipterous insects in the pollination of cocoa in Brazil. *Bull. Ent. Res.* 68(4): 559-574.
- Witjaksono, J. 2016. Cocoa Farming System in Indonesia and Its Sustainability Under Climate Change. *Agriculture, Forestry and Fisheries*. 5(5):170.
- Wood, G.A.R., Lass, R.A., 2001. *Cocoa: Fourth Edition*. John Wiley and Sons: USA.
- Young, A. M. 1983. Seasonal Differences in Abundance and Distribution of Cocoa-Pollinating Midges in Relation to Flowering and Fruit Set Between Shaded and Sunny Habitats of the La Lola Cocoa Farm in Costa Rica. *The Journal of Applied Ecology*. 20(3):801.
- Young, A. M. 1985. Pollen-Collecting by Stingless Bees on Cacao Flowers. *Experientia*. 41(6):760–62.
- Young, A. M., 1985. Studies of cecidomyiid midges (Diptera: Cecidomyiidae) as cocoa pollinators (*Theobroma cacao* L.) in Central America. *Proceedings of the Entomological Society of Washington*. 87(1): 49–79.
- Young, A. M., 1994. *The Chocolate Tree*. Smithsonian Institution Press, Washington.
- Zariman, A. Z., N. A. Omar and A. Nurul Huda. 2022. Plant Attractants and Rewards for Pollinators: Their Significance to Successful Crop Pollination. *International Journal of Life Sciences and Biotechnology*. 5(2): 270-293.
- Zhang, X., and Derrick. K. M. 2022. The Effects of Light Wavelength and Trapping Habitat on Surveillance of *Culicoides* Biting Midges (Diptera: Ceratopogonidae) in Alabama, *Journal of Medical Entomology*. 59(6): 2053–2065.