# STINGLESS BEE *Heterotrigona itama* Cockerell (APIDAE: MELIPONINI) AS A POTENTIAL POLLINATOR IN ROCK MELON *Cucumis melo* L. CULTIVATION

**By**

**SITI ASMA' BINTI SAMSUDIN**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

**February 2023**

**FP 2023 21**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

**STINGLESS BEE *Heterotrigona itama* Cockerell (APIDAE: MELIPONINI) AS A POTENTIAL POLLINATOR IN ROCK MELON *Cucumis melo* L. CULTIVATION**

By

**SITI ASMA' BINTI SAMSUDIN**

**February 2023**

**Chair : Associate Professor Nur Azura binti Adam, PhD**
**Faculty : Agriculture**

Rock melon (*Cucumis melo* L.) belongs to the family Cucurbitaceae and the genus *Cucumis* which comprises of 38 species worldwide. In Malaysia, the local demand for this fruit is increasing and there is also an enormous potential for international market. The normal pollination practice in rock melon is by hand pollination. However, hand pollination by human is currently not a preferred option since it is labor intensive and time consuming. Furthermore, rock melon produces lesser female flowers than male flowers, hence leading to poor fruit production. Application of insecticides is a major concern as it could harm insect pollinators, which result in colonies collapse. The first experiment was conducted using a sweep net that trapped insects, which were collected the insect and identified as pollinators in rock melon cultivation. Result showed *H. itama* population was the most abundant in rock melon cultivation and the peak hours of foraging activities was in the morning. The second experiment was determining the foraging activities, floral visitation frequency and activities rate of stingless bee in rock melon cultivation inside glasshouse. The foraging activities recorded were stingless bee flying into the hive, flying out from the hive and bring pollen into hive. The results showed, the flying out from hive activities was the highest number (1522 individuals) of stingless bees recorded. The peak hour for foraging activities by *H. itama* inside the greenhouse was in the morning, from 10 a.m. to 11 a.m. On floral visitation frequency, *H. itama* visited rock melon male flowers more frequently than female flowers. However, *H. itama* spent longer period foraging the female flowers (2.27 minutes) than the male flowers (1.49 minutes). The third experiment was conducted by using the ethylene to increase female flowers production. The source of the ethylene in this experiment were ethephon and epibrassinolide, with two concentrations of ethephon, at 250 ppm and 500 ppm. Concentrations for epibrassinolide were 10 µM and 1 µM, while distilled water was used as control. Result showed that the treatment with 250 ppm ethephon significantly increased ($P<0.05$) the production of female flowers. The application of ethylene with optimum concentration could increase the female flowers production without disturbing the natural growth of the rock melon crops such as the height of rock melon plant and the relative chlorophyll content. The final experiment was the bioassay on the *H. itama* to determine the toxicity level that cause mortality on stingless bee population. *H. itama* population was assessed with five common insecticides used in rock melon cultivation, namely Deltamethrin, Cypermethrin, Imidacloprid, Abamectin and Malathion. The insecticide with the highest toxicity was Imidacloprid, a low concentration at 57.53 ppm, after 24 hours significantly caused 50% mortality on the stingless bee population. The insecticide with the lowest toxicity on *H. itama* was Malathion, where a high concentration of 500.76 ppm resulted in 50% mortality after 24 hours. In conclusion, this study provides an overview for rock melon cultivation. *H. itama* was an effective and worthy pollinator candidate for rock melon cultivation. The application of optimal concentration of ethylene to boost female flowers production, and hence increase the yield of rock melon fruits. The use highly toxic insecticides are detrimental to populations of pollinators. Thus, the findings from the present study contribute to new and impactful knowledge gained by rock melon growers and is recommended as innovations on the cultural practice in modern rock melon industry in Malaysia.

**Keywords:** *Cucumis melo* L., *Heterotrigona itama*, pollination, rockmelon, stingless bee

**SDG:** GOAL 12: Responsible consumption and production, GOAL 15: Life on land

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**POTENSI KELULUT *Heterotrigona itama* Cockerell (APIDAE: MELIPONINI) SEBAGAI SERANGGA PENDEBUNGAAN DALAM PENANAMAN ROCK MELON (*Cucumis melo* L.)**

Oleh

**SITI ASMA' BINTI SAMSUDIN**

**Februari 2023**

**Pengerusi : Professor Madya Nur Azura binti Adam, PhD**
**Fakulti : Pertanian**

Rock melon (*Cucumis melo* L.) tergolong dalam keluarga Cucurbitaceae dan daripada genus *Cucumis* yang terdiri daripada 38 jenis spesis seluruh dunia. Di Malaysia, permintaan tempatan terhadap rock melon semakin meningkat dan mempunyai peluang yang luas untuk dipasarkan di peringkat antarabangsa. Amalan biasa untuk penghasilan buah rock melon adalah melalui pendebungaan berbantu menggunakan tangan. Pendebungaan berbantu melalui tangan didapati kurang berkesan, kerana memerlukan ramai tenaga kerja dan mengambil masa yang panjang. Tambahan pula, penghasilan bunga betina pokok rock melon adalah kurang daripada penghasilan bunga jantan. Kekurangan penghasilan bunga betina ini mengakibatkan kurangnya penghasilan buah rock melon. Penggunaan racun serangga dalam penanaman rock melon sangat dikhuatiri kerana racun serangga boleh mendatangkan keburukan dan memusnahkan kelestarian koloni serangga pendebunga. Pada kajian pertama, serangga pendebunga ditangkap menggunakan jaring hayun untuk mengenal pasti kehadiran serangga pendebunga dalam penanaman rock melon. Berdasarkan kepada keputusan, kelulut jenis *Heterotrigona itama* paling banyak ditemui dalam penanaman rock melon dan waktu aktif kelulut terbang mencari makanan ialah pada waktu pagi. Kajian kedua adalah untuk mengetahui tingkah laku kelulut, kekerapan lawatan pada bunga rock melon dan kadar aktiviti pada bunga rock melon di dalam rumah hijau. Pengamatan tingkah laku pencarian makanan bagi kelulut dijalankan dengan merekodkan terbang masuk ke dalam sarang, terbang keluar dari sarang dan membawa debunga ke dalam sarang. Hasil kajian menyatakan kelulut yang terbang keluar dari sarang (1522 ekor) adalah lebih tinggi berbanding terbang masuk ke dalam sarang dan membawa masuk debunga. Waktu puncak kelulut keluar

mencari makanan adalah antara pukul 10 pagi hingga 11 pagi. Hasil dari kekerapan lawatan kelulut pada bunga rock melon, kelulut lebih banyak melawat bunga jantan berbanding bunga betina. Bagi kadar aktiviti yang dilakukan oleh kelulut, kelulut akan berada lebih lama pada bunga betina (2.27 minit) berbanding pada bunga jantan (1.49 minit). Untuk kajian ketiga, penggunaan etilena kepada pokok rock melon untuk meningkatkan penghasilan bunga betina. Sumber etilena untuk kajian ketiga adalah daripada ethephon dan epibrassinolide, dua kadar kepekatan ethephon yang digunakan untuk kajian ialah 250 ppm dan 500 ppm, manakala untuk epibrassinolide ialah 10 µM dan 1 µM, dan air suling dijadikan sebagai kawalan. Didapati etilena pada kepekatan 250 ppm ethephon paling ketara ($P<0.05$) menghasilkan bunga betina berbanding kepekatan yang lain. Penggunaan etilena pada kadar yang optimum mampu meningkatkan penghasilan bunga betina rock melon tanpa mengganggu pertumbuhan alami tanaman rock melon. Kajian terakhir adalah bioassay tahap ketoksikkan racun serangga terhadap kadar kematian kelulut. Kelulut diuji dengan lima jenis racun serangga yang lazim digunakan dalam tanaman rock melon iaitu Delthamethrin, Cypermethrin, Imidacloprid, Abamectin dan Malathion. Dapatan kajian menunjukkan Imidacloprid paling tinggi tahap ketoksikannya. Kepekatan tahap rendah, iaitu 57.53 ppm, boleh menyebabkan kadar kematian 50% terhadap populasi kelulut selepas 24 jam. Racun serangga Malathion paling rendah kesan toksik terhadap populasi kelulut, di mana kepekatan 500.76 ppm menyebabkan kadar kematian 50% populasi kelulut selepas 24 jam. Kesimpulannya, *H. itama* didapati paling efektif dan berbaloi sebagai calon serangga pendebunga bagi rock melon. Penggunaan etilena untuk merangsang dan meningkatkan pengeluaran bunga betina, dan juga meningkatkan penghasilan buah rock melon. Penggunaan racun serangga boleh mengancam populasi serangga pendebunga dan penghasilan buah rock melon. Dapatan kajian ini menyumbang kepada ilmu pengetahuan baharu dan memberi impak kepada pengusaha dan wajar disyorkan sebagai inovasi dalam amalan pertanian tanaman untuk industri moden bagi rock melon negara Malaysia.

**Kata kunci:** *Cucumis melo* L., *Heterotrigona itama*, kelulut, melon batu, pendebunga

**SDG:** MATLAMAT 12: Penggunaan dan pengeluaran yang bertanggungjawab, MATLAMAT 15: Kehidupan didarat

## ACKNOWLEDGEMENTS

All praises and thanks to Allah S.W.T, the Magnificent and Merciful for all His guidance, enlightening my way through this rough and arduous journey in pursuit of knowledge. Alhamdullilah, for all the kindness and assurance that Allah has granted unto me in fulfilling this mission.

First and foremost, I would like to express my heartiest gratitude to the Chair of the Supervisory Committee, Associate Professor Dr. Nur Azura binti Adam, and my co-supervisors, Associate Professor Dr. Norida binti Mazlan and Dr. Puteri Edaroyati binti Megat Wahab, for their untiring guidance, support and encouragement, as well as for the valuable knowledge and extensive discussion on my study. May Allah reward my above-mentioned mentors and their respective family members the highest Jannah in return for the knowledge that they have sincerely shared with and instilled in me.

I dedicate this precious knowledge to my beloved son, Muhammad Mustaffa bin Muhammad Farizal and to my rock, my loving husband, Muhammad Farizal bin Muhammad, who loyally stands by my side in every up and down, in every tears, through thick and thin of my endeavour. I nearly gave up on my study due to stress incurred during thesis writing. He never fails to cheer me up, raise me up to complete this precious study. Not too much if I say, this study was done by two, his strength makes me complete today. The most precious prayers from my first love, my mother Hjh.Siti Meriam bt Awang**,** I am here today because of her du'a, she never fails to du'a for her daughter to patient and success in study. Alhamdulillah, through her du'a I succeed to finish my study.

My grateful thanks to my Abah, Hj.Samsudin bin Adam, silently and secretly continuously praying for me and providing moral support so that I could finish this study. The greatest and punchy advice from my sisters, Rabiatul 'Adawiah Samsudin and Solehah Samsudin. The secret du'a from my siblings Amir Samsudin, Zulkarnain Samsudin, Mursyid Samsudin and Aqil Samsudin. Not to be forgotten, my large in-law family, to my mother in-law, Zainab binti Ahmad, the lovely mother in-law that I have, I am really grateful to have you as a mother and all in-laws in my life, al Fatihah to my late father in-law (May his soul rest in peace).

I owe a great deal of appreciations to my laboratory mates and my bestie by heart! Yes, without them this journey was the loneliness ever. I am gratefully thankful to Mr Hadif Haziq (soon Dr. Haziq), who have taught me and help me a lot during this study. Big thanks to my beloved bestie, Mr. Syukri Tan Shilan, Dr. Wan Nur Asiah, Dr. Marina Roseli, Dr. Hau Eng Huan, Miss Sarah Fatin and Mrs Naimah for being with me through this joyful study journey. Following that, I would like to thank to members of staff of Entomology Laboratory, viz. Mr. Audi, Mr. Tamsil, Mr. Shamsuddin, and many more for their endless help. Last but not least, to Dr. Syari Jamian, a great lecturer with endless teaching and mentoring, and to Dr. Khairuddin Abdul Rahim, a former researcher at Agensi Nuklear Malaysia, for sharing of knowledge regarding my study.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

**Nur Azura binti Adam, PhD**
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

**Norida binti Mazlan, PhD**
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

**Puteri Edaroyati binti Megat Wahab, PhD**
Senior Lecturer
Faculty of Agriculture
University Putra Malaysia
(Member)

**ZALILAH MOHD SHARIFF,PhD**
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 10 October 2024

# TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| g | Gram |
| ACC | 1-aminocyclopropane-1-carboxylic |
| gy | Gynoecious |
| a | Andromonoecious |
| tm | Trimonoecious |
| ACS | 1-aminocyclopropane-1-carboxylate synthase |
| CsETRI | Ethylene receptor gene |
| DNA | Deoxyribonucleic acid |
| EpiBL | Epibrassinolide |
| BRs | Brasinosteroid |
| Hg | Mercury |
| Cu | Copper |

# CHAPTER 1

# INTRODUCTION

## 1.1 Background of Study

The production of the rock melon (*Cucumis melo* L.) in Malaysia has increased tremendously between 2011 and 2015, a leap from 311 metric tonnes in 2011 to 5,118 metric tonnes in 2015 (Department of Agriculture, 2015). By 2025, Malaysia will focus on exporting fresh melons, where 62% of the melons will be exported to Singapore, 33% to China and the remaining 5% to the United Arab Emirates (UAE). Rock melon has contributed to the economic development during the implementation of the National Agro-Food Policy (2011-2020). Although Malaysia is not a major producer of rock melon, it has already established local and export market for rock melon, or the cucurbit family.

*Cucumis melo* L. is andromonoecious plant that have separate female (pistillate) and male (staminate) flower on same plant. It is known as a plant whose flowers are unisexual, with male and female flowers on different plants (dioecious) or on the same plant (monoecious). Having separate pistillate and staminate flowers on the same plant, the pistillate flowers appear in axillary cluster at each lateral branch, while the staminate flowers appear along the lateral buds on the main stem.

Stingless bee belongs to family Apidae tribe Meliponini. *Heterotrigona itama* species commonly found and actively domesticated in Malaysia. *Heterotrigona itama* is small (approximately 4 to 5 cm) but it can produce a large amount of honey under favorable conditions and sufficient food sources. In Malaysia, stingless bee rearing started to boom with the local honey industry in 2012 (Mustafa et al., 2018), since the honey from stingless bees has an exotically different taste than those produced by honeybees. Stingless bee honey is slightly sour and less viscous than honeybee honey. However, its characteristics also depend on the season and flower sources found in the vicinity of stingless beehives. Pollination by stingless bees helped in increasing fruit quantity and improving quality of the fruits (Santos et al., 2008).

## 1.2 Problem Statement

Pollination by hand is non-cost effective since it requires a lot of manpower to pollinate the rock melon flowers. This method is labour intensive and time consuming since it requires workers to pollinate the male and female flowers at appropriate times. Missing the right time to pollinate the flowers will lead to a great loss on fruit production. Rock melon flowers bloom early in the morning and wilt at noon and onwards. It is critical to pollinate the flowers at the right time to enable pollens from the stamens to be in contact with the stigmas before the female flowers wilt. Hence, an accurate time is crucial; for if the workers miss the right time to pollinate the flowers, the effort will be a waste.

The use of the insecticides in rock melon cultivation is excessive, since the rock melon is highly susceptible to insect pest diseases. Growers applied insecticides as early as at planting until fruiting. This due to the international market demand that need the high and uniform quality of rock melon fruits. Specially to penetrate the Japan and China market, the size, color, weight and texture of rock melon fruit must be uniform in quality. To comply with all this market demand, growers tend to apply excessive insecticide to prevent fruit from insect pest. The toxicity level of the insecticides used are crucial for a healthy colony of stingless bees. Insecticides with the lowest toxicity should be used maintain high quality in rock melon fruits.

## 1.3 Justification of Study

The contribution of stingless bee as a pollinator is more significant than the honeybees, since stingless bees are more effective in pollinating many cultivated plant species (Roubik, 2014). Stingless bees can tolerate hot temperatures in comparison to honeybees (Remy et al., 2014). In the present study the stingless bees were place in a greenhouse where rock melon was cultivated. The pollinators should be able to transfer as many pollen grains as possible onto the stigmas since they can move from flower to flower (Rader et al., 2009). Effectiveness as a pollinator can also be measured based on its foraging behavior, pollinating ability, and pollinator ecology (O' Neill, 2010).

## 1.4 Objectives of Study

The objectives of this study are:

1. to assess diversity of insect pollinators of rock melon in an open cultivation.
2. to investigate the foraging behaviours of stingless bee (*Heterotrigona itama*) in rock melon cultivation.
3. to determine the ethylene concentration to increase female flowers for stingless bee food source and rock melon fruit production.
4. to determine toxicity level of selected insecticides towards *H. itama* population.

# REFERENCES


Abbott, W. S. (1925). Classic Paper: Abbott's Formula a Method of Computing the Effectiveness of an Insecticide. *J. Econ. Ent.* 18, 265.

Abou-Shaara, H. F., Al-Ghamdi, A. A. & Mohamed, A. A. (2012). Tolerance of two honey bee races to various temperature and relative humidity gradients. *Environmental and Experimental Biology,* 10: 133–138.

Abrol, D. P., Devinder, S., Manoj, K., Singh, S. K., & Singh, P. K. (2013). Pollinator diversity and its impact on cauliflower (Brassica campestris v ar. botrytis) pollination. *Annals of Agri Bio Research*, *18*(3), 383-385.

Abrol, D.P. (2017). Pollination biology. In Asiatic Honey bee, *Apis cerana: In Biodiversity Conservation and Agricultural Production* (Ed), (pp 509-574). Springer publication No.34, New York.

Abrol, D. P., Gorka, A. K., Ansari, M. J., Al-Ghamdi, A., & Al-Kahtani, S. (2019). Impact of insect pollinators on yield and fruit quality of strawberry. *Saudi journal of biological sciences*, *26*(3), 524-530.

Abreu-Olivera, C., Hilário, S. D., Luz, C. F. P., & dos Santos, I. A. (2014). Pollen and nectar foraging by Melipona quadrifasciata anthidioides Lepeletier (Hymenoptera: Apidae: Meliponini) in natural habitat. *Sociobiology*, *61*(4), 441-448.

Abd El-Ghany, N.M. (2020). Pheromones and Chemical Communication in Insects. IntechOpen. doi: 10.5772/intechopen.92384

Ahanger, M.A., Ashraf, M., Bajguz, A. and Ahmad, P. (2018) Brassinosteroids Regulate Growth in Plants under Stressful Environments and Crosstalk with Other Potential Phytohormones. Journal of Plant Growth Regulation, 37, 1007-1024.https://doi.org/10.1007/s00344-018-98552

Ahmad, F., Hasali, N. H., Zamri, A. I., Lani, M. N., Mubarak, A., & Chilek, T. Z. T. (2018). Physico-chemical analysis and antibacterial activity of raw honey of stingless bee farmed in coastal areas in Kelantan and Terengganu. Malaysian Applied Biology, 47(4), 145-151.

Aljedani, D. M. (2017). Effects of abamectin and deltamethrin to the foragers honeybee workers of Apis mellifera jemenatica (Hymenoptera: Apidae) under laboratory conditions. *Saudi Journal of Biological Sciences*, *24*(5), 1007-1015.

Ail-Catzim C.E., Cerna-Chávez E, Landeros-Flores J, Ochoa-Fuentes Y, García- López A.M., (2015) Efecto de Insecticidas Sobre la Mortalidad y Depredación de Chrysoperla carnea (Neuroptera: Chrysopidae). Southwestern Entomologist 40(3): 565-575.

Aizen, M. A., & Feinsinger, P. (2003). Bees not to be? Responses of insect pollinator faunas and flower pollination to habitat fragmentation. In *How landscapes change* (pp. 111-129).

Amendt, J. (2021). Insect Decline—A Forensic Issue? Insect, 12, 324.

Arikawa, K., Inokuma, K., & Eguchi, E. (1987). Pentachromatic visual system in a butterfly. *Naturwissenschaften*, *74*(6), 297-298.

Asad, S. A., Farooq, M., Afzal, A., & West, H. (2019). Integrated phytobial heavy metal remediation strategies for a sustainable clean environment-a review. Chemosphere, 217, 925-941.

Australia Melons Association (AMA). (2010). Melon pollination information, Retrieved from http://beeaware.org.au/pollination/pollinator-reliant-crops/melons/

Azpiazu C, Medina P, Adán Á, Sánchez-Ramos I, Del Estal P, Fereres A, Viñuela E. (2020). The Role of Annual Flowering Plant Strips on a Melon Crop in Central Spain. Influence on Pollinators and Crop. Insects.Jan 20;11(1):66.

Barrett S.C.H. (2002). The evolution of plant sexual diversity. Nat Rev Genet 2002; 3:274-84.

Barrett S.C.H. (1998) The evolution of mating strategies in flowering plants. Trends Plant Sci 3:335–341

Basari, N., Ramli, S. N., & Mohd Khairi, N. (2018). Food reward and distance influence the foraging pattern of stingless bee, *Heterotrigona itama*. *Insects*, 9(4): 138.

Bassett JL, Badiou A, Belzunces LP (2019) In vivo metabolic fate of [C-14]-acetamiprid in six biological compartments of the honeybee, Apis mellifera L. Pest Manag Sci 61:742–748

Baum, K. A., & Wallen, K. E. (2011). Potential bias in pan trapping as a function of floral abundance. *Journal of the Kansas entomological society*, *84*(2), 155-159.

Bhandhary, A., Surampalli, R. Y., Adams, C. D., Champagne, P., Ong, S. K., Tyagi, R. D., & Zhang, T. C. (2009). Contaminants of Emerging Environmental Concern.

Boualem A, Fergany M, Fernandez R, Troadec C, Martin A, Morin H, et al. (2008) A conserved mutation in an ethylene biosynthesis enzyme leads to andromonoecy in melons. Science 321: 836–838. doi: 10. 1126/science.1159023 PMID: 18687965

Boualem A, Troadec C, Camps C, Lemhemdi A, Morin H, Sari MA, et al. (2015) A cucurbit androecy gene reveals how unisexual flowers develop and dioecy emerges. Science 350: 688–691. doi: 10. 1126/science.aac8370 PMID: 26542573

Boualem A, Lemhemdi A, Sari MA, Pignoly S, Troadec C, Abou Choucha F, Solmaz I, Sari N, Dogimont C, Bendahmane A. (2016) The Andromonoecious Sex Determination Gene Predates the Separation of *Cucumis* and *Citrullus* Genera. PLoS One. May 12;11(5).

Bonmatin JM, Moineau I, Charvet R, Fleche C, Colin ME, Bengsch ER (2014) A LC/APCI-MS/MS method for analysis of imidacloprid in soils, in plants, and in pollens. Anal Chem 75: 2027–2033

Bozsik A., Gonzales-Ruiz R., Hurtado-Lara B., (2009). Distribution of thr Chysoperla carnea complex in southern Spain (Neuroptera: Chrydsopidea). Analele Univeritatii din Oradea, Fascicula: Protectia Mediului 14: 60-65.

Besard L, Mommaerts V, Abdu-Alla G, Smagghe G (2010) Laboratory assessment of lethal and sublethal side-effects supports a more benign profile of spinetoram compared to spinosad in the bumblebee Bombus terrestris. Pest Manag Sci 67:541–547

Blacquiere, T., Smagghe, G., Gestel, C.A.M.V., Mommaerts, V. (2012) Neonicotinoids in bees: a review on concentrations, side-effects and risk assessment. Ecotoxicology 21, 973–992

Biesmeijer, J. C., Slaa, E. J., Castro, M. S., Viana, B. F., Kleinert, A. M. P. & Imperatriz- Fonseca, V. L. (2005). Connectance of Brazilian social bee – food plant networks is influenced by habitat, but not by latitude, altitude or network size. *Biota Neotropica,* 5: 1–8.

Carange J, Longpré F, Daoust B, Martinoli MG. (2011). 24-Epibrassinolide, a Phytosterol from the Brassinosteroid Family, Protects Dopaminergic Cells against MPP-Induced Oxidative Stress and Apoptosis. J Toxicol. 2011; 2011:392859

Carvalho SM, Carvalho GA, Carvalho CF, Bueno Filho JSS, Baptista APM (2009) Toxicidade de acaricidas inseticidas empregados na citricultura para abelha africanizada Apis mellifera L. 1758 (Hymenoptera: Apidae). Arq Inst Biol 76:597–606

Camargo, J. M., & Pedro, S. R. (2003). Neotropical Meliponini: the genus Partamona Schwarz, 1939 (Hymenoptera, Apidae, Apinae)- bionomy and biogeography. *Revista Brasileira de Entomologia*, *47*, 311- 372.

Chinh, T. X., Grob, G. B., Meeuwsen, F. J., & Sommeijer, M. J. (2003). Patterns of male production in the stingless bee *Melipona favosa* (Apidae, Meliponini). *Apidologie*, *34*(2), 161-170.

Clouse SD, Sasse JM (1998) Brassinosteroids: essential regulators of plant growth and development. Annu Rev Plant Physiol Plant Mol Biol 49:427–451. doi: 10.1146/annurev.arplant.49.1.427

Cortopassi-Laurino M., Imperatriz-Fonseca V.L., Roubik D.W., Dollin A., Heard T., Aguilar I.B., Eardley C., Nogueira-Neto P. (2006). Global meliponiculture: challenges and opportunities, Apidologie 37, 275–292

Chhillar B.S., Gulati R, Bhatnagar P. (2007). Bioassay. In: Agricultural Acarology. Published by Daya Publishing House, New Delhi, 220-230.

Chagnon, M., Samson-Robert, O., Labrie, G., & Fournier, V. (2014). Neonicotinoid-contaminated puddles of water represent a risk of intoxication for honey bees. *PloS one*, *9*(12), e108443.

Couvillon, M. J., Walter, C. M., Blows, E. M., Czaczkes, T. J., Alton, K. L., & Ratnieks, F. L. (2015). Busy bees: variation in insect flower-visiting rates across multiple plant species. *Psyche*, *2015*.

Cruz, D. O., B. M. Freitas, L. A. Silva, S. E. M. Silva, and I. G. A. Bomfim. (2005). Pollination efficiency of the stingless bee *Melipona subnitida* on greenhouse sweet pepper. Pesqui. Agropecu. Bras. 40: 1197–1201

Cui, B., Liu, C., Zeleke, K. T., Hu, C., Wu, H., Cui, E., ... & Gao, F. (2021). Risk of secondary soil salinization under mixed irrigation using brackish water and reclaimed water. *Agronomy*, *11*(10), 2039.

Danaraddi, V. S Kumara, O., Sannathimmappa, H. G., Basavarajappa, D. N., & Patil, R. (2006). Long term integrated nutrient management in rice-maize cropping system. *IOSR Journal of Agriculture and Veterinary Science*, *8*(4), 61-66.

Daryono, B. & Prasetya, Eko & Sumarlina, Sumarlina & Sartika, Dian & Sufi, Aprilia. (2018). The effect of ethepon treatment on the formation of flower in melon (*Cucumis melo* L.). Digital Press Life Sciences. 1. 10.29037/digitalpress.21239.

Department of Agriculture (DOA). (2015). Fruit Crop Statistics of Malaysia 2012-2020. Putrajaya: Department of Agriculture.

Department of Agriculture (DOA). (2018). *Phytosanitary Requirements for Exportation of Horticulture Produce from Malaysia*. Putrajaya: Department of Agriculture.

Delgado-Carrillo, O., Martén-Rodríguez, S., Ashworth, L., Aguilar, R., Lopezaraiza-Mikel, M., & Quesada, M. (2018). Temporal variation in pollination services to Cucurbita moschata is determined by bee gender and diversity. *Ecosphere*, *9*(11), e02506.

Del Sarto, M. C. L., Oliveira, E. E., Guedes, R. N. C., & Campos, L. A. O. (2014). Differential insecticide susceptibility of the Neotropical stingless bee Melipona quadrifasciata and the honey bee *Apis mellifera*. *Apidologie*, *45*(5), 626-636.

Dewiman. A. V., Caserio, B., Rezende, F. T., Ribeiro, S. P., Del-Claro, K., & Fagundes, R. (2017). Extrafloral-nectaries and interspecific aggressiveness regulates day/night turnover of ant species foraging for nectar on *Bionia coriacea*. *Austral Ecology*, *42*(3), 317-328.

Decourtye, A., Devillers, J., Genecque, E., Menach, K. L., Budzinski, H., Cluzeau, S., & Pham-Delègue, M. H. (2005). Comparative sublethal toxicity of nine pesticides on olfactory learning performances of the honeybee *Apis mellifera*. *Archives of environmental contamination and toxicology*, *48*(2), 242-250.

DeGrandi-Hoffman, G., & Watkins, J. C. (2000). The foraging activity of honey bees *Apis mellifera* and non—Apis bees on hybrid sunflowers (*Helianthus annuus*) and its influence on cross—pollination and seed set. *Journal of Apicultural Research*, *39*(1-2), 37-45.

Dieko''ter Leadbeater, E., & Chittka, L. (2009). *Social information use in foraging insects* (pp. 135-146). CRC Press, Boca Raton, Fla, USA.

DiBartolomeis M., Kegley S., Mineau P., Radford R., Klein K., (2019). An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States. PLoS One 14.

Dobrikova, A. G., Vladkova, R. S., Rashkov, G. D., Todinova, S. J., Krumova, S. B., & Apostolova, E. L. (2014). Effects of exogenous 24-epibrassinolide on the photosynthetic membranes under non-stress conditions. *Plant physiology and biochemistry*, *80*, 75-82.

Dornhaus, A., & Chittka, L. (2001). Food alert in bumblebees (Bombus terrestris): possible mechanisms and evolutionary implications. *Behavioral Ecology and Sociobiology*, *50*(6), 570-576.

Duan Q.H., Wang D.H., Xu Z.H., Bai S.N. (2008). Stamen development in Arabidopsis is arrested by organ-specific overexpression of a cucumber ethylene synthesis gene CsACO2; 228:537-43.

Droege, G., Barker, K., Seberg, O., Coddington, J., Benson, E., Berendsohn, W. G., & Zhou, X. (2011). The global genome biodiversity network (GGBN) data standard specification. *Database*, *2016*.

Eltz, T., Brühl, C.A., Imiyabir, Z. & Linsenmair, K.E. (2003). Nesting and nest trees of stingless bees (Apidae: Meliponini) in lowland dipterocarp forests in Sabah, Malaysia, with implications for forest management. *Forest Ecology and Management*, 172: 301-313.

El Balla, K., Rakszegi, M., Li, Z., Bekes, F., Bencze, S., & Veisz, O. (2011). Quality of winter wheat in relation to heat and drought shock after anthesis. *Czech Journal of Food Sciences*, *29*(2), 117-128.

Elfatih M., Tshabalala, T., Abdel-Rahman, Masemola, C., Ncube, B., Ndhlala, A. R., & Mutanga, O. (2021). Predicting medicinal phytochemicals of Moringa oleifera using hyperspectral reflectance of tree canopies. *International Journal of Remote Sensing*, *42*(10), 3955-3980.

Elbert A, Haas M, Springer B, Thielert W, Nauen R (2008) Applied aspects of neonicotinoid uses in crop protection. Pest Manag Sci 64:1099–1105

FAO, Food and Agriculture Organization of the United Nations, Rome, (2015). FAO Statistical Pocketbook.

Farisya and Kumara Thevan. (2015). Characterization of Nest Structure and Foraging Activity of Stingless Bee, *Geniotrigona Thoracica* (Hymenopetra: Apidae; Meliponini). Jurnal Teknologi (Sciences & Engineering) 77:33 69–74

Fidalgo, A.O. & Kleinert, A.M.P. (2007). Foraging behavior of Melipona rufiventris Lepeletier (Apinae; Meliponini) in Ubatuba, SP, Brazil. Brazilian Journal of Biology 67(1): 133-140.

Fidalgo, A. O. and Kleinert A. M. P. (2010). Floral preferences and climate influence in nectar and pollen foraging by Melipona rufiventris Lepeletier (Hymenoptera: Meliponini) in Ubatuba, Sao Paulo State, Brazil. Neutropical Entomology. 39(6):879-884

Franceschinelli, E. V., Neto, C. M. S., Lima, F. G., Gonçalves, B. B., Bergamini, L. L., Bergamini, B. A. R., & Elias, M. A. (2013). Native bees pollinate tomato flowers and increase fruit production. *Journal of Pollination Ecology*, *11*, 41-45.

Friedman Shmulik P. (2022). Irrigation methods, Reference Module in Earth Systems and Environmental Sciences, Elsevier, ISBN 9780124095489

Gallo M.A., and Lawryk N.J., (2005) Organic phosphorus pesticides. In: Hayes WJ Jr. and Laws ER Jr. (eds.) Handbook of Pesticide Toxicology, vol. 3, pp. 976–985. San Diego: Academic Press.

Ganthmann, A., & Tscharntke, T. (2012). Landscapes with wild bee habitats enhance pollination, fruit set and yield of sweet cherry. *Biological Conservation*, *153*, 101-107.

Gardiner, M. A., Tuell, J. K., Isaacs, R., Gibbs, J., Ascher, J. S., & Landis, D. A. (2010). Implications of three biofuel crops for beneficial arthropods in agricultural landscapes. *BioEnergy Research*, *3*(1), 6-19.

Gervais, J. A.; Luukinen, B.; Buhl, K.; Stone, D. (2010). Imidacloprid General Fact Sheet; National Pesticide Information Center, Oregon State University Extension Services

Gervais, J. A., Luukinen, B., Buhl, K., Stone D. (2009). Malathion General Fact Sheet; National Pesticide Information Center, Oregon State University Extension Services.

Gebremedhn, H., Tadesse, A., & Belay, T. (2014). Relating climatic factors to foraging behavior of honeybees (Apis mellifera) during blooming period of Guizotia abyssinica (LF). *Livestock Research for Rural Development*, *26*(4), 2-7.

Ghazi, R., Zulqurnain, N.S. & Azmi, W.A. (2019) Melittopalynological studies of stingless bees from the east coast of Peninsular Malaysia. In Vit P., Pedro S., Roubik D. (Eds.) *Pot-Pollen in Stingless Bee Melittology* (pp. 77-88). Berlin, Germany: Springer, Cham.

Gill, R., Ramos-Rodriguez, O., Raine, N. (2012) Combined pesticide exposure severely affects individual- and colony-level traits in bees. Nature 491, 105–109

Gill, R. J. & Raine, N. E., (2015). Tasteless pesticides affect bees in the field. *Nature*, *521*(7550), 38-39.

Graham, L., & Jones, K. N. (1996). Resource partitioning and per-flower foraging efficiency in two bumble bee species. *American Midland Naturalist*, 401-406.

Greenleaf, S. S., Williams, N. M., Winfree, R., & Kremen, C. (2007). Bee foraging ranges and their relationship to body size. Oecologia, 153(3), 589-596.

Grumet, M. (2005). Comparative ontogeny of male and female flowers of *Cucumis sativus*. P. 288-304.

Guedes N.M.P., Guedes R.N.C., Ferreira GH, Silva L.B. (2009). Flight takes-off and walking behavior of insecticide-susceptible and–resistant strains of *Sitophilus zeamais* exposed to deltamethrin. Bulletin of entomological research 99(4): 393-400.

Guzman Casado, G. I. & González de Molina, M., (2017). Agroecology and ecological intensification. A discussion from a metabolic point of view. *Sustainability*, *9*(1), 86.

Guzman, L. M Thompson, P. L., De Meester, L., Horváth, Z., Ptacnik, R., Vanschoenwinkel, B., & Chase, J. M. (2020). A process-based metacommunity framework linking local and regional scale community ecology. *Ecology letters*, *23*(9), 1314-1329.Goulson 2009 =chp 4

Gómez-Guzmán J.A., García-Marín F.J., Sáinz-Pérez M., González-Ruiz R. (2017). Behavioural Resistance in Insects: Its Potential Use as Bio Indicator of Organic Agriculture. IOP Conference Series: Earth and Environmental Science 95(4): 1-10.

Gómez-Guzmán J.A., González-Ruiz R. (2020). The influence of agricultural olive growing practices on abundance and behavioral resistance of beneficial insects. Agronomy. Special Issue "Impact of Agricultural Practices on Biodiversity of Soil Invertebrates"

Godfray, H. C. J., Blacquiere, T., Field, L. M., Hails, R. S., Petrokofsky, G., Potts, S. G., & McLean, A. R. (2014). A restatement of the natural science evidence base concerning neonicotinoid insecticides and insect pollinators. *Proceedings of the Royal Society B: Biological Sciences*, *281*(1786), 20140558.

Groten, J. P., Feron, V. J., & Sühnel, J. (2001). Toxicology of simple and complex mixtures. *Trends in pharmacological sciences*, *22*(6), 316-322.

Grüter C. & Ratnieks L.W. (2011). Flower constancy in insect pollinators: Adaptive foraging behaviour or cognitive limitation, Communicative & Integrative Biology, 4:6, 633-636.

Halcroft, M. T. (2012). Investigations into the biology, behaviour and phylogeny of a potential crop pollinator: The Australian stingless bee, Austroplebeia australis. Doctor of Philosophy thesis, University of Western Sydney.

Hao YJ, Wang DH, Peng YB, Bai SL, Xu LY, Li YQ, Zu ZH, Bai SN (2003) DNA damage in the early primordial anther is closely correlated with stamen arrest in the female flower of cucumber (Cucumis sativus L.) Planta 217:888–89Harder 2004.

Hao Dongdong, Xiangzhong Sun, Biao Ma, Jin-Song Zhang, Hongwei Guo. (2017). 6 - Ethylene, Editor(s): Jiayang Li, Chuanyou Li, Steven M. Smith, Hormone Metabolism and Signaling in Plants, Academic Press, Pages 203-241, ISBN 9780128115626,

Hassan Iqbal., Rashid, M. A., Begum, R. A., & Shahjahan, R. M. (2012). Toxicity of Cypermethrin and Malathion on Rice Weevil Sitophilus oryzae (L.) and Their Effect on Esterase Isozymes. *Journal of Chemical, Biological and Physical Sciences (JCBPS)*, *3*(1), 305.

Heard T. A. (1999). The role of stingless bees in crop pollination. Annual review of entomology, 44(1), 183-206.

Heard, T. (2016). *The Australian native bee book*. West End: Sugarbag Bees.

Hein, L. (2009). The economic value of the pollination service, a review across scales. *The Open Ecology Journal*, *2*(1).

Hilário, S. D., Imperatriz-Fonseca, V. L., & Kleinert, A. D. M. P. (2001). Responses to climatic factors by foragers of Plebeia pugnax Moure (in litt.) (Apidae, Meliponinae). Revista Brasileira de Biologia, 61, 191-196.

Hossain D., Karim M.A., Pramanik M.H.R., Rahman A.M.S., (2006). Effect of gibberellic acid on flowering and fruit development of bittergourd (Momordica charantia L.). Inter. J. Botany, 2: 329-332.

Horsburgh, M., Semple, J. C., & Kevan, P. G. (2011). Relative pollinator effectiveness of insect floral visitors to two sympatric species of wild aster: Symphyotrichum lanceolatum (Willd.) Nesom and S. lateriflorum (L.) Löve & Löve (Asteraceae: Astereae). *Rhodora*, *113*(953), 64-86.

Howlett, B. G., Nelson, W. R., Pattemore, D. E., & Gee, M. (2015). Pollination of macadamia: Review and opportunities for improving yields. *Scientia Horticulturae*, *197*, 411-419.

Iqbal, N., Khan, N. A., Nazar, R., and Teixeira da Silva, J. A. (2012). Ethylene stimulated photosynthesis results from increased nitrogen and sulfur. Environ. Exp. Bot. 78, 84–90. doi: 10.1016/j.envexpbot.2011.12.025

Jaapar F., Halim, M., Mispan, M. R., Jajuli, R., Saranum, M. M., Zainuddin, M. Y., Ghazi, R. & Idris, A. G. (2016). The diversity and abundace of stingless bee (Hymenoptera: Meliponini) in Peninsular Malaysia. *Advance in Environmental Biology*, 10(9): 1–7.

Jayaprakasam, B., Seeram, N. P., & Nair, M. G. (2003). Anticancer and antiinflammatory activities of cucurbitacins from Cucurbita andreana. *Cancer letters*, *189*(1), 11-16.

Janeczko A, Filek W, Biesaga-Kościelniak J, Marcińska I, Janeczko Z (2003) The influence of animal sex hormones on the induction of flowering in *Arabidopsis thaliana*: comparison with the effect of 24-epibrassinolide. Plant Cell Tiss OrganCult72:147–151. doi:10.1023/A:1022291718398

Ji, X., Zimmermann, J., Polle, A., & Fischer, U. (2015). Auxin is a long-range signal that acts independently of ethylene signaling on leaf abscission in Populus. *Frontiers in Plant Science*, *6*, 634.

Ji, X., Zhao, Z., Li, Q., Dimova, R., Lipowsky, R., & Liu, Y. (2016). Molar mass fractionation in aqueous two-phase polymer solutions of dextran and poly (ethylene glycol). *Journal of Chromatography A*, *1452*, 107-115.

Jin, X., Qin, Z., Wu, T., & Zhou, X. (2011). Identification of ethylene-responsive genes in ethrel-treated shoot apices of cucumber by suppression subtractive hybridization. *Plant molecular biology reporter*, *29*(4), 875-884.

Johan Ceusters, & Bram Van de Poel. (2018). Ethylene exerts species-specific and age-dependent control of photosynthesis. *Plant Physiology*, *176*(4), 2601-2612.

Johnson, R. M., Ellis, M. D., Mullin, C. A., & Frazier, M. (2010). Pesticides and honey bee toxicity–USA. *Apidologie*, *41*(3), 312-331.

Johnson, S. D., & Anderson, B. (2010). Coevolution between food-rewarding flowers and their pollinators. *Evolution: Education and Outreach*, *3*(1), 32-39.

Jose- Fumero C. J., & Elvia Meléndez-Ackerman, (2007). Relative pollination effectiveness of floral visitors of *Pitcairnia angustifolia* (Bromeliaceae). *American Journal of Botany*, *94*(3), 419-424.

Kater, M. M., Franken, J., Carney, K. J., Colombo, L., & Angenent, G. C. (2001). Sex determination in the monoecious species cucumber is confined to specific floral whorls. *The Plant Cell*, *13*(3), 481-493.

Kaluza, B. F., Wallace, H., Heard, T. A., Klein, A. M., & Leonhardt, S. D. (2016). Urban gardens promote bee foraging over natural habitats and plantations. *Ecology and evolution*, *6*(5), 1304-1316.

Kane J. H., (2005). "Pollination potential of the bee *Osmia aglaia* for cultivated red raspberries and blackberries (*Rubus*: Rosaceae)," *HortScience*, vol. 40, no. 6, pp. 1705–1708.

Kesy, J., Trzaskalska A., Galosh E., and Kopeewicz. (2003). Inhibitory effect of brassinosterioid in plant development. Biol. Plantarum 47:597-600

Keogh. R, Mullins. I, Robinson.A. (2010). the pollination text is an excerpt from Melon: Pollination aware fact sheet. RIRDC Publication No. 10/128.

Kerr, W.E. (1969) Some aspects of the evolution of social bees, Evol. Biol. 3, 119–175.

Kerr, W. E. (1965). Evolution of communication in bees and its role in speciation. Evolution 14, 326–327. Khan (2005)

Khan, N. A., Mir, M. R., Nazar, R., and Singh, S. (2008). The application of ethephon (an ethylene releaser) increases growth, photosynthesis and nitrogen accumulation in mustard (*Brassica juncea* L.) under high nitrogen levels. Plant Biol. 10, 534–538. doi: 10.1111/j.1438- 8677.2008. 00054.x

Khosravi, G.R., Anderson, I.C. (1991). Growth, yield, and yield components of ethephon-treated corn. Plant Growth Regul 10, 27–36

Klein, A. M., Vaissiera, B., Cane, J. H. Steffan-Dewenter, I., Cunningham, S. A., Kremen, C., Tscharntke, T. (2007). Importance of crop pollinators in changing landscape for world crops. Proceeding Royal Society London B, Biological Sciences. 274: 303-313.

Kleinert, A. D. M. P.& Malgodi-Braga, K. S., & (2004). Could *Tetragonisca angustula* Latreille (Apinae, Meliponini) be effective as strawberry pollinator in greenhouses. *Australian Journal of Agricultural Research*, *55*(7), 771-773.

Kleinert, A. M. P.& Malagodi-Braga, K. S., (2009). Comparative analysis of two sampling techniques for pollen gathered by *Nannotrigona testaceicornis* Lepeletier (Apidae, Meliponini). *Genetics and molecular research*, *8*(2), 596-606.

Klatt, B. K., A. Holzschuh, C. Westphal, Y. Clough, I. Smit, E. Pawelzik, and T. Tscharntke. (2013). Bee pollination improves crop quality, shelf life and commercial value. Proc. Biol. Sci. 281: 2013–2440

Kiill, L. H., Siqueira, K. M., Márcia., Silva, T. A., Gama, D. R., Araujo, D., & Pereira Neto, (2016). Frequency and foraging behavior of *Apis mellifera* in two melons hybrids in Juazeiro, state of Bahia, Brazil. *Anais da Academia Brasileira de Ciências*, *86*, 2049-2055.

Kim, H., Hwang, H., Hong, J.W., Lee, Y.N., Ahn, I.P., Yoon, I.S., Yoo, S.D., Lee, S., Lee, S.C., Kim, B.G. (2017). A rice orthologue of the ABA transduction pathway in seed germination and early seedling growth. J. Exp. Bot., 63, 1013–1024

Koubala, B. B., Bassang'na, G., Yapo, B. M., & Raihanatou, R. (2016). Morphological and biochemical changes during muskmelon (Cucumis melo var. Tibish) fruit maturation. *J. Food Nutr. Sci*, *4*(1), 18-28.

Kouonon, L. C., Jacquemart, A. L., Zoro Bi, A. I., Bertin, P., Baudoin, J. P., & Dje, Y. (2009). Reproductive biology of the andromonoecious Cucumis melo subsp. agrestis (Cucurbitaceae). *Annals of Botany*, *104*(6), 1129-1139.

Kooner, K. S., Jaskaran, S., & Saimbhi, M. S. (2000). Effect of plant growth substances on growth, sex expression and fruit yield in bottle gourd cv. Punjab Komal. *Haryana Journal of Horticultural Sciences*, *29*(3/4), 268-269.

Kumar Rahul, Ashima Khurana and Arun K. Sharma. (2013). Role of plant hormones and their interplay in development and ripening of fleshy fruits. Journal of Experimental Botany, Vol. 65, No. 16, pp. 4561–4575; doi:10.1093/jxb/eru277

Kwapong Peter, Kwame Aidoo, Rofela Combey, Afia Karikari. (2010). Stingless Bees a Training Manual for Stingless Beekeeping. Unimax Macmillan LTD.

Lau, J. Y., Pang, C. C., Ramsden, L., & Saunders, R. M. (2017). Stigmatic exudate in the Annonaceae: Pollinator reward, pollen germination medium or extragynoecial compitum. *Journal of Integrative Plant Biology*, *59*(12), 881-894.

Laurino, D., Porporato, M., Patetta, A., & Manino, A. (2011). Toxicity of neonicotinoid insecticides to honey bees: laboratory tests. *Bulletin of Insectology*, *64*(1), 107-113.

Leonhardt, S. D., Dworschak, K., & Eltz, T., & Nico, B. (2007). Foraging loads of stingless bees and utilisation of stored nectar for pollen harvesting. *Apidologie* 38(2): 125-135.

Little, H.A. (2005). Modification of sex expression in transgenic melon via altered ethylene production and perception. PhD diss. Mich, State Univ., East Langsing.

Li Zheng, Sanwen Huang, Shiqiang Liu, Junsong Pan, Zhonghua Zhang, Qianyi Tao, Qiuxiang Shi, Zhiqi Jia, Weiwei Zhang, Huiming Chen, Longting Si, Lihuang Zhu, Run Cai, (2009). Molecular Isolation of the M Gene Suggests That a Conserved-Residue Conversion Induces the Formation of Bisexual Flowers in Cucumber Plants, Genetics, Volume 182, Issue 4, Pages 1381–1385,

Li, Z. (2010). Modeling pesticide residues in nectar and pollen in support of pesticide exposure assessment for honeybees: A generic modeling approach. *Ecotoxicology and Environmental Safety*, *236*, 113507.

Li, Z., & He, Y. (2020). Roles of brassinosteroids in plant reproduction. *International Journal of Molecular Sciences*, *21*(3), 872.

Li, D., Mou, W., Van de Poel, B., & Chang, C. (2022). Something old, something new: Conservation of the ethylene precursor 1-amino-cyclopropane-1-carboxylic acid as a signalling molecule. Current Opinion in Plant Biology, 65, 102116.

Li Q, Guo W, Chen B, Pan F, Yang H, Zhou J, Wang G, Li X. (2021). Transcriptional and Hormonal Responses in Ethephon-Induced Promotion of Femaleness in Pumpkin. Front Plant Sci.; 12:715487

Liow, L. H., Sodhi, N. S., & Elmqvist, T. (2001). Bee diversity along a disturbance gradient in tropical lowland forests of south-east Asia. *Journal of applied ecology*, 180-192.

Loy, X., Wainwright, C. E., & Mayfield, M. M. (2009). Asteraceae invaders have limited impacts on the pollination of common native annual species in SW Western Australia’s open woodland wildflower communities. *Plant Ecology*, *216*(8), 1103-1115.

Loy, J. B. (2012). Breeding squash and pumpkins. *Genetics, genomics and breeding of cucurbits*, 115-161.

Matthew, G.A. (2018). A History of Pesticide, CABI

Mann, L., & Robinson, J. (1952). Cantaloupe fruit set: Relationship to fertilization, seed development, and fruit growth studied to determine causes of drop. *California Agriculture*, *6*(2), 10-12.

Malagodi-Braga, K. S., & Kleinert, A. D. M. P. (2004). Could Tetragonisca angustula Latreille (Apinae, Meliponini) be effective as strawberry pollinator in greenhouses? *Australian Journal of Agricultural Research*, *55*(7), 771-7732

Manzano-Rivaz, Martínez, L. A., I. V., & Aguilera-Gómez, L. I. (2009). Feeding habits of Anoura geoffroyi (Chiroptera: Phyllostomidae) in Ixtapan del Oro, Mexico State. *Acta zoológica mexicana*, *25*(1), 161-175.

Manzano, S.; Martínez, C.; Megías, Z.; Gómez, P.; Garrido, D.; Jamilena, V M. (2011). The role of ethylene and brassinosteroids in the control of sex expression and flower development in Cucurbita pepo. Plant Growth Regul, 65, 213–221.

Manzano, S., Megias, Z., Martínez, C., Barrera, A., Garrido, D., Valenzuela, J. L., & Jamilena, M. (2003). Effects of 1-MCP on different postharvest quality parameters in zucchini. In *VI International Conference on Managing Quality in Chains 1091* (pp. 83-89).

Manzano S, Martinez C, Garcia JM, Megias Z, Jamilena M (2014) Involvement of ethylene in sex expression and female flower development in watermelon (Citrullus lanatus). Plant Physiol Biochem 85: 96– 104. PMID: 25463265

Martin Gonzalez, A. M., Allesina, S., Rodrigo, A., & Bosch, J. (2009). Drivers of compartmentalization in a Mediterranean pollination network. *Oikos*, *121*(12), 2001-2013.

Marco, D. P., & Coelho, F. M. (2004). Services performed by the ecosystem: forest remnants influence agricultural cultures' pollination and production. *Biodiversity & Conservation*, *13*(7), 1245-1255.

Martínez, C., Manzano, S., Megías, Z., Garrido, D., Picó, B., & Jamilena, M. (2014). Involvement of ethylene biosynthesis and signalling in fruit set and early fruit development in zucchini squash (Cucurbita pepo L.). *BMC plant biology*, *13*(1), 1- 14.

Marshall, S. A. (2006). *Insects: their natural history and diversity: with a photographic guide to insects of eastern North America* (p. 718). Buffalo, NY: Firefly Books.

Martelli, F., Zhongyuan, Z., Wang, J., Wong, C. O., Karagas, N. E., Roessner, U., & Batterham, P. (2020). Low doses of the neonicotinoid insecticide imidacloprid induce ROS triggering neurological and metabolic impairments in Drosophila. *Proceedings of the National Academy of Sciences*, *117*(41), 25840- 25850.

Mario N. Palladini, G., Milani, P., Foli, A., Obici, L., Lavatelli, F., & Merlini, G. (2014). Oral melphalan and dexamethasone grants extended survival with minimal toxicity in AL amyloidosis: long-term results of a risk-adapted approach. *Haematologica*, *99*(4), 743.

Mayfield, M. M., Waser, N. M., & Price, M. V. (2001). Exploring the 'most effective pollinator principle'with complex flowers: bumblebees and Ipomopsis aggregata. Annals of Botany, 88(4), 591-596.

Mehdi, A. Purya, M., Ali, G., (2006). Improving emergence and early seedling growth of two cool season grasses affected by seed priming under saline conditions. *African Journal of Agricultural Research*, *5*(11), 1288- 1296.

Mehdi, S., Liu, J., Topping, J., Tarkowski, P., & Lindsey, K. (2010). Modelling and experimental analysis of hormonal crosstalk in Arabidopsis. *Molecular Systems Biology*, *6*(1), 373.

Meléndez Ramírez, V., Ayala, R., & Delfín González, H. (2018). Crop pollination by stingless bees. In *Pot-pollen in stingless bee melittology* (pp. 139-153). Springer, Cham.

Milbus, H. and Tatlioglu, T. (2004). Molecular characterization and isolation of the gene for femeleness in cucumber (*Cucumis sativus* L.). Theor, Appl. Genet. 109:1669-1676

Michener C.D. (1979). Biogeography of the bees. Annals of the Missouri Botanical Garden 66: 277– 347.

Michener C.D. (2007). The Bees of the World. Second edition. Johns Hopkins University Press; Baltimore, USA. 953 pp.

Moran, J. A., Mitchell, A. K., Goodmanson, G., & Stockburger, K. A. (2000). Differentiation among effects of nitrogen fertilization treatments on conifer seedlings by foliar reflectance: a comparison of methods. Tree physiology, 20(16), 1113-1120.

Mohd Fauzi, M. J. & Tih, S. (2010). Potential of selected Malaysian tropical fruits in Europe: strategic framework to penetrate EU market. *Journal of Agribusiness Marketing,* Special Edition: 1-27.

Mohd Mansor, I., & Wan Iryani W. I., (2018). Development of stingless beekeeping projects in Malaysia. *E3S Web of Conferences* 52:1-5

Mohd Yasin, N., Ahmad, M. S., Aziz, N. A. & Ahmad, A. K. (2008). Exploratory study in assessing the market potential and distribution network of selected tropical fruits in Europe. *Journal of Agribusiness Marketing,* 1(12): 1-16.

Momose, K., Yumoto, T., Nagamitsu, T., Makoto, K., Nagamasu, H., Sakai, S., Harrison, R., Hamid, A., & Inoue, T. (1998). Pollination Biology in a Lowland Dipterocarp Forest in Sarawak, Malaysia. I. Characteristics of the Plant-Pollinator Community in a Lowland Dipterocarp Forest. *American Journal of Botany*, 85: 1477-1501.

Mustafa M.Z., Yaacob NS, Sulaiman S.A. (2018) Reinventing the Honey Industry: Opportunities of the Stingless Bee. Malays J Med Sci. Jul;25(4):1-5. doi: 10.21315/mjms2018.25.4.1. Epub 2018 Aug 30. PMID: 30914843; PMCID: PMC6422541.

Murren, C. J. (2002). Effects of habitat fragmentation on pollination: pollinators, pollinia viability and reproductive success. *Journal of Ecology*, *90*(1), 100-107.

Muday, G. K., Rahman, A., and Binder, B. M. (2012). Auxin and ethylene: collaborators or competitors? Trends Plant Sci. 17, 181–195. doi: 10.1016/ j. tplants.2012.02.001

Nasreen A, Mustafa G, Ashfaq M (2005) Mortality of Chrysoperla carnea (Stephens) (Neuroptera: Chrysopidae) after exposure to some insecticides; laboratory studies. South Pacific Studies 26(1): 1-6.

Nazar, R., Khan, M. I. R., Iqbal, N., Masood, A., & Khan, N. A. (2014). Involvement of ethylene in reversal of salt-inhibited photosynthesis by sulfur in mustard. *Physiologia plantarum*, *152*(2), 331-344.

Nguyen B.K., Saegerman C., Pirard C., Mignon J., Widart J., Tuirionet B., Verheggen F.J., Berkvens D., De Pauw E., Haubruge E. (2009) Does imidacloprid seed- treated maize have an impact on honey bee mortality? J. Econ. Entomol. 102, 616– 623.

Nieh, J. C. (2004). Recruitment communication in stingless bees (Hymenoptera, Apidae, Meliponini). *Apidologie* 35 (2):159-182.

Nica, D., Bianu, E., & Chioveanu, G. (2004). A case of acute intoxication with deltamethrin in bee colonies in Romania. *Apiacta*, *39*(1), 71-77.

Norowi, M. H., Mohd Fahimee, J., Sajap, A. S., Rosliza, J. & Suri, R. (2010). Conservation and Sustainable Utilization of Stingless Bees for Pollination Services in Agricultural Ecosystems in Malaysia. In *Proceedings of International Seminar on Enhancement of Functional Biodiversity Relevant to Sustainable Food Production*, Tsukuba, Japan, 9-11 November 2010 (pp 1–11). Tsukuba: National Institute for Agro-Environmental Sciences.

Nurul Huda, A., Che Salmah, M. R., Abu Hassan, A., Hamdan, A., & Abdul Razak, M. N. (2015). Pollination services of mango flower pollinators. *Journal of Insect Science* 15(1)113.

Nunez-Silva, S. D. Hilario, S. F. P ´ ersio de Souza, and V. ´ L. Imperatriz-Fonseca, (2010) “Foraging activity in Plebeia remota, a stingless bee species, is influenced by the reproductive state of a colony,” Psyche, vol. 1, pp. 1–17,

Nunes-Silva, P., M. Hnrcir, L. Shipp, V. L. Imperatriz-Fonseca, and P. G. Kevan. (2013). The behavior of Bombus impatiens (Apidae, Bombini) on tomato (Lycopersicon esculentum Mill. Solanaceae) flowers: pollination and reward perception. J. Pollinat. Ecol. 11: 33–40

O’Neill SD (1997) Pollination regulation of flower development. Ann Rev Plant Physiol Plant Mol Biol 48:547–574

O’Neill, R. P., and K. M. O’Neill. (2010). Pollen load composition and size in the leafcutting bee Megachile rotundata (Hymenoptera: Megachilidae). Apidologie 42: 223–233.

O’Toole, C. (1993) Diversity of native bees and agroecosystems. Hymenoptera and Biodiversity (ed. by J. LaSalle and I. Gauld), pp. 69–106. Commonwealth Agricultural Bureau International, London.

Ollerton, J. (2017). Pollinator diversity: distribution, ecological function, and conservation. *Annual Review of Ecology, Evolution and Systematics*, *48*.

Oster, G., & Heinrich, B. (1976). Why do bumblebees major? A mathematical model. *Ecological Monographs*, *46*(2), 129-133.

Ozgiir M, Skirvin R.M., K.H. Al-Juboor, M. Kushad. (2017). Effects of Ethylene on the Production of Female Flowers by "Burpless Hybrid" Cucumber (*Cucumis Sativus* L.) In Vitro. Biotechnology & Biotechnological Equipment, 18:1, 35-38,

Pang, C. C., & Saunders, R. M. (2014). The evolution of alternative mechanisms that promote outcrossing in Annonaceae, a self-compatible family of early-divergent angiosperms. *Botanical Journal of the Linnean Society*, *174*(1), 93-109.

Payan, M.C., Penaranda, A., Rosales, R., Garrido, D., Gomez, P., Jamilena, M., Holmes, G.J., (2006). Ethylene mediates the induction of fruits with attached flower in zucchini squash. In: Holmes, G.J. (Ed.), Proceedings of Cucurbitaceae 2006. Universal Press, Raleigh, NC, pp. 171-179.

Papadopoulou, E.; Grumet, R. (2005). Brassinosteriod-induced femaleness in cucumber and relationship to ethylene production. HortScience, 40, 1763–1767

Papadopoulou E (2002) Sex expression in cucurbits: the role of ethylene synthesis and perception and sex determination genes. PhD Dissertation. Michigan State University

Papadopoulou E, Grumet R (1998) Exogenous brassinosteroids influence sex expression and vegetative development of cucumber (Cucumis sativus L.) plants. In: McCreight JD (ed) Cucurbitaceae '98. Evaluation and enhancement of cucurbit germplasm. ASHS Press, Alexandria, pp 235–240.

Paxton R.J., Bego L.R., Shah M.M., Mateus S. (2001). Low mating frequency of queens in the stingless bee Scaptotrigona postica and worker paternity of males, Behav. Ecol. Sociobiol. 53, 174–181.

Pedro, S.R.M. (2014) The Stingless Bee Fauna in Brazil (Hymenoptera: Apidae). Sociobiology. 61, 348–354.

Pen˜aranda A, Paya´n MC, Garrido D, Go´mez P, Jamilena M. (2007). Production of fruits with attached flowers in zucchini squash is correlated with the arrest of maturation of female flowers. J Hort Sci Biotechnol 82:579–584

Pelley, M. E., & McLaren, I. P. L. (2002). The interaction of learning and memory in associative networks. In *Proceedings of the 2002 International Joint Conference on Neural Networks. IJCNN'02 (Cat. No. 02CH37290)* (Vol. 3, pp. 2899-2904). IEEE.

Petra Jiroutova, Jana Oklestkova and Miroslav Strnad. (2018). Crosstalk between Brassinosteroids and Ethylene during Plant Growth and under Abiotic Stress Conditions.

Petruzzello L, Coraggio I, Leubner-Metzger G. (2014). Ethylene promotes ethylene biosynthesis during pea seed germination by positive feedback regulation of 1-aminocyclo-propane-1-carboxylic acid oxidase. Planta 211:144–1

Pietro Gennari (Chief Statistician and Director, ESS). (2015). Prepared by the Statistics Division. FAO Statistical Pocketbook (FAOSTAT)

Polatto, L. P., Chaud-Netto, J., & Alves-Junior, V. V. (2014). Influence of abiotic factors and floral resource availability on daily foraging activity of bees. *Journal of Insect Behavior*, *27*(5), 593-612.

Potts, S. G., Biesmeijer, J. C., Kremen, C., Neumann, P., Schweiger, O., & Kunin, W. E. (2010). Global pollinator declines: trends, impacts and drivers. *Trends in ecology & evolution*, *25*(6), 345-353.

Prothro, J., Abdel-Haleem, H., Bachlava, E., White, V., Knapp, S., & McGregor, C. (2013). Quantitative trait loci associated with sex expression in an inter-subspecific watermelon population. Journal of the American Society for Horticultural Science, 138(2), 125-130.

Quiroga-Murcia, D. E., Zotti, M. J., & Pech-Pech, E. E. (2017). Toxicity evaluation of two insecticides on *Tetragonisca angustula* and *Scaptotrigona xanthotricha* (Hymenoptera: Apidae). *Agronomía Colombiana*, *35*(3).

Rader, R., Howlett, B. G., Cunningham, S. A., Westcott, D. A., Newstrom-Lloyd, L. E., Walker, M. K., & Edwards, W. (2009). Alternative Pollinator Taxa Are Equally Efficient but Not as Effective as the Honeybee in a Mass Flowering Crop. Journal of Applied Ecology, 46(5): 1080-1087.

Ramirez-Romero, R., Chaufaux, J., & Pham-Delègue, M. H. (2005). Effects of Cry1Ab protoxin, deltamethrin and imidacloprid on the foraging activity and the learning performances of the honeybee Apis mellifera, a comparative approach. *Apidologie*, *36*(4), 601-611.

Rashidi Majid and Karim Arabsalmani. (2017). Effects of Ethephon Application at Different Growth Stages on Male Flowers in Cantaloupe (*Cucumis melo* L.). American-Eurasian Journal of Scientific Research 12 (1): 07-12

Radwan, A.A., (1988). Effect of ethephon on growth flowering and sex expression of monoecious cucumber plants. Cairo Univ. (Egypt). Faculty of Agriculture, 13: 378-884

Ramalho M., Kleinert-Giovannini A., Imperatriz-Fonseca V.L. (1990) Important bee plants for stingless bees (*Melipona* and Trigonini) and Africanised honeybees (*Apis mellifera*) in neotropical habitats: a review, Apidologie 21, 469-488.

Ramalho M., Tereza C.G., Katia S. Malagodi-Braga & Vera L. Imperatriz-Fonseca (1994) Pollen Harvest by Stingless Bee Foragers (Hymenoptera, Apidae, Meliponinae), Grana, 33:4-5, 239-244.

Remy Vandame Enoc Go Mez-Escobar., Pablo Liedo, Pablo Montoya, and Daniel Sanchez. (2014). Behavioral Response of Two Species of Stingless Bees and the HoneyBee (Hymenoptera: Apidae) to GF-120. Ecotoxicology. Entomological Society of America.

Rianti, P., Suryobroto, B., & Atmowidi, T. R. I. (2010). Diversity and effectiveness of insect pollinators of Jatropha curcas L. (Euphorbiaceae). *HAYATI Journal of Biosciences*, *17*(1), 38-42.

Rincon, M., Quezada-Euán, J. J. G., May-Itzá, W. D. J., De la Rua, P., & Paxton, R. J. (2012). Genetic and phenotypic differentiationin endemic Scaptotrigona hellwegeri (Apidae: Meliponini): implications for the conservation of stingless bee populations in contrasting environments. *Insect Conservation and Diversity*, *5*(6), 433-443.

Rosales, R., Jamilena, M., Gómez, P., & Garrido, D. (2009). Hormonal control of floral abscission in zucchini squash (Cucurbita pepo). *Plant growth regulation*, *58*(1), 1-14.

Roselino, A. C., Santos, S. B., Hrncir, M., & Bego, L. R. (2009). Differences between the quality of strawberries (Fragaria x ananassa) pollinated by the stingless bees *Scaptotrigona aff. depilis* and *Nannotrigona testaceicornis*. *Genetics and Molecular Research*, *8*(2), 539-545.

Roubik David W. (2002). The value of bees to the coffee harvest. Smithsonian Tropical Research Institute, Unit 0948, APO AA 34002-0948, USA.

Roubik, D. W. (2006). Stingless bee nesting biology. *Apidologie*, *37*(2), 124-143.

Roubik D.W., Sakai S., Hamid Karim A.A. (Eds.) (2014) Pollination ecology and the rain forest: Sarawak Studies, Springer Ecological Studies No. 174, Springer Sciences + Business Media Inc., New York.

Roubik D. W., Kenneth W. McCravy, Joseph Van Dyke, Thomas J. Creedy, (2016). "Orchid Bees (Hymenoptera: Apidae: Euglossini) of Cusuco National Park, State of Cortés, Honduras," Florida Entomologist, 99(4), 765-768.

Robinson, W. S. (2009). Ecological correlations and the behavior of individuals. *International journal of epidemiology*, *38*(2), 337-341.

Rhodes H.A., Wilson W.T., Sonnet P.E., Stoner A. (2006). Exposure of Apis mellifera (Hymenoptera, Apidae) to bee-collected pollen containing residues of microencapsulated methyl parathion, Environ. Entomol. 8, 944–948.

Ricketts, T. H. (2004). Tropical forest fragments enhance pollinator activity in nearby coffee crops. *Conservation biology*, *18*(5), 1262-1271.

Russell, A. L., Morrison, S. J., Moschonas, E. H., & Papaj, D. R. (2017). Patterns of pollen and nectar foraging specialization by bumblebees over multiple timescales using RFID. *Scientific reports*, *7*(1), 1-13.

Rudich, J., A.H. Halevy and N. Kedar, (2019). The levels of phytohormones in monoecious and in monoecious and gynoecious cucumbers as affected by photoperiod and ethephon. Plant Physiol, 50: 585-590

Saganuwan A.S., (2011) A modified arithmetical method of Reed and Muench for determination of a relatively ideal median lethal dose (LD50) Afr J Pharm. 5(12):1543–1546

Sanchez-Bayo F., Goka K., (2014) Pesticide Residues and Bees – A Risk Assessment. PLoS ONE 9(4): e94482. doi: 10.1371/journal.pone.0094482

Santos Solange A.B., Ana C. Roselino and Luci R. Bego. (2008). Pollination of Cucumber, Cucumis sativus L. (Cucurbitales: Cucurbitaceae), by the Stingless Bees Scaptotrigona aff. depilis Moure and Nannotrigona testaceicornis Lepeletier (Hymenoptera: Meliponini) in Greenhouses. Ecology, Behavior and Bionomics.

Sanchez-Bayo, F., & Goka, K. (2014). Pesticide residues and bees–a risk assessment. PloS one, 9(4), e94482.

Santos D., do Prado, F. S. R., D. M., de Almeida Oliveira, T. M., Burgarelli, J. A. M., Castele, J. B., & Vieira, E. M. (2020). Determination and uptake of abamectin and difenoconazole in the stingless bee Melipona scutellaris Latreille, 1811 via oral and topic acute exposure. *Environmental Pollution*, *265*, 114313.

Saltveit M.E., (2003), 'Fresh-cut vegetables', in Postharvest Physiology and Pathologyof Vegetables, eds. J.A. Bartz and JK Brecht, Marcel Dekker, Inc. pp. 691– 712. ISBN: 0-8247-0687-0.

Saltveit, M. E. (2011). Melon (Cucumis melo L.). In *Postharvest biology and technology of tropical and subtropical fruits* (pp. 31-45e). Woodhead Publishing.

Salim, H. M. W., Dzulkiply, A. D., Harrison, R. D., Fletcher, C., Kassim, A. R. & Potts, M. D. (2012). Stingless bee (Hymenoptera: Apidae: Meliponini) diversity in Dipterocarp Forest Reserves in Peninsular Malaysia. *The Raffles Bulletin of Zoology*, 60(1): 213–219.

Sakagami, S. F., Inoue, T., & Salmah, S. (1990). Stingless bees of central Sumatra. *Stingless bees of central Sumatra.*, 125-137.

Samsudin, S. F., Mamat, M. R. & Hazmi, I. R. (2018). Taxonomic study on selected species of stingless bee (Hymenoptera: Apidae: Meliponini) in Peninsular Malaysia. *Serangga,* 23(2): 203-258.

Sayyed, A. H., Saeed, S., Noor-Ul-Ane, M., & Crickmore, N. (2008). Genetic, biochemical, and physiological characterization of spinosad resistance in Plutella xylostella (Lepidoptera: Plutellidae). *Journal of Economic Entomology*, *101*(5), 1658-1666.

Shamsul Bahri, A. R., Sanusi, J. & Nur Azura, A. (2017). Ultrastructural comparison of three stingless bee's species of Borneo. *Malaysian Journal of Microscopy,* 13(1): 8-16.

Shahid Mahamud, Jamaludin Salim, Mohammad Roff Mohd Noor, Ab Halim ab Hamid, Mohamad Abdul Manas dan Suwardi Afandi Ahmad. (2017). Manual Teknologi Fertigasi Penanaman Cili, Rockmelon dan Tomato. Institut Penyelidikan dan Kemajuan Pertanian Malaysia (MARDI).

Sidik Norrizah Jaafar, Saiyidah Nafisah Hashim, Yaseer Suhaimi Mohd and Shamsiah Abdullah, 2012. Characterization of Plant Growth, Yield and Fruit Quality of Rockmelon (*Cucumis melo*) Cultivars Planted on Soilless Culture. *Journal of Plant Sciences, 7: 186-193.*

Siregar EH, Atmowidi T, Kahono S. 2016. Diversity and abundance of insect pollinators in different agricultural lands in Jambi, Sumatera. Hayati J Biosci 23: 13-17.

Silva D., Yamamoto, M., C. I., Augusto, S. C., Barbosa, A. A. A., & Oliveira, P. E. (2010). The role of bee diversity in pollination and fruit set of yellow passion fruit (Passiflora edulis forma flavicarpa, Passifloraceae) crop in Central Brazil. *Apidologie*, *43*(5), 515-526.

Smith, H. G., Häussler, J., Sahlin, U., Baey, C., & Clough, Y. (2017). Pollinator population size and pollination ecosystem service responses to enhancing floral and nesting resources. *Ecology and evolution*, *7*(6), 1898-1908.

Slaa Ester Judith, Luis Alejandro Sánchez Chaves, Katia Sampaio Malagodi-Braga and Frouke Elisabeth Hofstede. (2006). Stingless bees in applied pollination: practice and perspectives. Apidologie, 37 ;293-315

Sommeijer, M.J., de Bruijn, L.L., Meeuwsen, F.J.A.J. & Slaa, E.J. (2003). Reproductive behaviour of stingless bees: nest departures of non-accepted gynes and nuptial flights in *Melipona favosa* (Hymenoptera: Apidae, Meliponini). Entomologische Berichten-Nederlandsche Entomologische Vereenigung, 63(1): 7-13.

Souza Wong, Julia M. W. RD; de, Russell RD; Kendall, Cyril W. C. PhD; Emam, Azadeh MSc; Jenkins, David J. A. MD. (2006). Colonic Health: Fermentation and Short Chain Fatty Acids. Journal of Clinical Gastroenterology: Volume 40 - Issue 3 - p 235-243

Sondhi, N., Bhardwaj, R., Kaur, S. *et al.* (2008). Isolation of 24-epibrassinolide from leaves of *Aegle marmelos* and evaluation of its antigenotoxicity employing *Allium cepa* chromosomal aberration assay. *Plant Growth Regul* **54**, 217–224. https://doi.org/10.1007/s10725-007-92427

Soldà, L., Tapparo, A., Giorio, C., *et al.* (2013). UHPLC-DAD method for the determination of neonicotinoid insecticides in single bees and its relevance in honeybee colony loss investigations. *Anal Bioanal Chem* **405**, 1007–1014. https://doi.org/10.1007/s00216-012-6338-3

Suhaizan Lob, Norezienda Afiffi, Shamsul Bahri Abdul Razak, Nurul Faziha Ibrahim and Iffah Hazirah Mohd Nawi. (2017). Composition and

Identification of Pollen Collected by Stingless Bee (*Heterotrigona itama*) In Forested and Coastal Area of Terengganu, Malaysia. Malays. Appl. Biol. 46(3): 227–232

Suge, H. (1986). Reproductive development of higher plants as influenced by brassinolide. *Plant and cell physiology*, *27*(2), 199-205.

Sun, M. B, Wang, Z. G., Sun, M. B., Wang, H. B., Yu, J. F., Liang, J. H., & Zhuang, F. C. (2015). Mixing-related low frequency oscillation of combustion in an ethylene-fueled supersonic combustor. *Proceedings of the Combustion Institute*, *35*(2), 2137-2144.

Suchail, S., Guez, D., & Belzunces, L. P. (2001). Discrepancy between acute and chronic toxicity induced by imidacloprid and its metabolites in Apis mellifera. *Environmental Toxicology and Chemistry: An International Journal*, *20*(11), 2482-2486.Stonghellini 2002-chp 3

Svensson, B., Lagerlöf, J., & Svensson, B. G. (2000). Habitat preferences of nest- seeking bumble bees (Hymenoptera: Apidae) in an agricultural landscape. *Agriculture, Ecosystems & Environment*, *77*(3), 247-255.

Taniguchi, M., Kiba, T., Sakakibara, H., Ueguchi, C., Mizuno, T., &. (1998). Expression of Arabidopsis response regulator homologs is induced by cytokinins and nitrate. *FEBS letters*, *429*(3), 259-262.

Tanveer, M., Shahzad, B., Sharma, A., & Khan, E. A. (2019). 24-Epibrassinolide application in plants: An implication for improving drought stress tolerance in plants. *Plant Physiology and Biochemistry*, *135*, 295-303.

Tapparo A., Marton D., Giorio C., Zanella A., Solda L., (2012). Assessment of the environmental exposure of honeybees to particulate matter containing neonicotinoid insecticides coming from corn coated seeds. Environmental Science & Technology 46: 2592–2599.

Tholen, D., Boom, C., Noguchi, K. O., Ueda, S., Katase, T., & Terashima, I. (2008). The chloroplast avoidance response decreases internal conductance to CO2 diffusion in Arabidopsis thaliana leaves. *Plant, Cell & Environment*, *31*(11), 1688-1700.

Thompson, H., & Wilkins, S. (2003). Assessment of the synergy and repellency of pyrethroid/fungicide mixtures. *Bulletin of Insectology*, *56*(1), 131-134.

Trebitsh T, Staub JE, O'Neill SD (1997) Identification of a 1-aminocyclopropane-1- carboxylic acid synthase gene linked to the female (F) locus that enhances female sex expression in cucumber. Plant Physiol 113:987–995

Tschoeke, P. H., Oliveira, E. E., Dalcin, M. S., Silveira-Tschoeke, M. C. A., & Santos, G. R. (2015). Diversity and flower-visiting rates of bee species as potential pollinators of melon (Cucumis melo L.) in the Brazilian Cerrado. *Scientia Horticulturae*, *186*, 207-216.

Tomé, H. V. V., Barbosa, W. F., Corrêa, A. S., Gontijo, L. M., Martins, G. F., & Guedes, R. N. C. (2015). Reduced-risk insecticides in Neotropical stingless bee species: impact on survival and activity. *Annals of Applied Biology*, *167*(2), 186-196.

Tomlin, C. D. (2000). *The pesticide manual: a world compendium* (No. Ed. 15). British Crop Production Council.

Tylianakis, J. M., Tscharntke, T., & Lewis, O. T. (2007). Habitat modification alters the structure of tropical host–parasitoid food webs. Nature, 445(7124), 202-205.

Ujjwal L., Uday D., Prakash K., (2022). The pollination efficiency of a pollinator depends on its foraging strategy, flowering phenology, and the flower characteristics of a plant species. Journal of Asia-Pacific Entomology.Volume 25, Issue 2,

Wang, B., Zhang, J., Xia, X., Zhang, W.H. (2010) Ameliorative effect of brassinosteroid and ethylene on germination of cucumber seeds in the presence of sodium chloride. Plant Growth Regul. 2011, 65, 407–413

Warner, H. and Leopold, A.L., (1969). Ethylene evolution from 2-chloroethyl phosphonic acid. Plant Physiol 44: 156-58.

Wahizatul, A. A., Chuah, T. S. & Nur Suhaili, S. (2016). Pollination efficiency of the stingless bee, *Heterotrigona itama* (Hymenoptera: Apidae) on chili (*Capsicum annuum*) in greenhouse. *Journal of Tropical Plant Physiology,* 8(1): 1-11.

Wahizatul, A. A., Ghazi, R. & Nasharuddin, I. S. (2019). Morphological, Nest Architecture and Colony Characteristics of Stingless Bees (Hymenoptera; Apidae; Meliponini) from Tasik Kenyir, Terengganu. In M. T. Abdullah et al. (Eds.) *Greater Kenyir Landscapes* (pp. 111-122). Cham, Switzerland: Springer International Publishing.

Wahizatul Afzan Azmi, W. Z. Wan Sembok, N. Yusuf, M. F. Mohd. Hatta, A. F. Salleh, M. A. H. Hamzah, and S. N. Ramli. (2018). Effects of Pollination by the Indo- Malaya Stingless Bee (Hymenoptera: Apidae) on the Quality of Greenhouse Produced Rockmelon. Journal of Economic Entomology.

Wahizatul, A. A., Samsuri, N., Firdaus, M., Hatta, M., Ghazi, R. & Chuah, T. S. (2017). Effects of stingless bee (*Heterotrigona itama*) pollination on greenhouse cucumber (*Cucumis sativus*). *Malaysian Applied Biology,* 46: 51-55.

Wahizatul, A. A., Zulqurnain, N.S. & Ghazi, R. (2015). Melissopalynology and foraging activity of stingless bees, *Lepidotrigona terminata* (Hymenoptera: Apidae) from an apiary in Besut, Terengganu. *Journal of Sustainability Science and Management,* 10: 27-35.

Wan Nur Asiah, W. M. A., Sajap, A. S., Nur Azura, A. & Norowi, M. H. (2015). *Flight intensity of two species of stingless bees Heterotrigona itama and Geniotrigona thoracica and its relationships with temperature, light intensity and relative humidity. Serangga,* 20(1): 35-42.

West, B. T., Heeringa, S. G., & Berglund, P. A. (2017). Applied survey data analysis. chapman and hall/CRC.

Williams GM, Linker HM, Waldvogel MG, Leidy RB, Schal C. (2005) Comparison of conventional and integrated pest management programs in public schools. J Econ Entomol.;98(4):1275-83.

Vardhini, B. V., Rao, S. S. R., Sujatha, E., & Anuradha, S. (2002). Brassinosteroids– a new class of phytohormones. Current Science, 1239-1245.

Vardhini B.V., Rao S.S.R., (1998). Effect of brassinosteroids on growth, metabolite content and yield of Arachis hypogaea. Phytochemistry 48:927–930.

Velthuis, Hayo H.W., Dirk Koedam and Vera L. Imperatriz-Fonseca. (2005). The males of Melipona and other stingless bees, and their mothers. Apidologie:36 (2).: 169 – 185.

Veiga, L. M., Barnett, A. A., Boyle, S. A., Norconk, M. M., Palminteri, S., Santos, R. R., & Ferrari, S. F. (2012). Terrestrial Activity in Pitheciins (C acajao, C hiropotes, and P ithecia). *American Journal of Primatology*, *74*(12), 1106-1127.

Vollet-Neto, A, Menezes, C., Marsaioli, A. J., Zampieri, D., Fontoura, I. C., Luchessi, A. D., & Imperatriz-Fonseca, V. L. (2015). A Brazilian social bee must cultivate fungus to survive. *Current Biology*, *25*(21), 2851-2855.

Yamasaki S., Fujii N, Takahashi H. (2005). The ethylene-regulated expression of CS- ETR2 and CS-ERS genes in cucumber plants and their possible involvement with sex expression in flowers. Plant Cell Physiol 41:608–616

Yamasaki S, Fujii N, Matsuura S, Mizusawa H, Takahashi H (2001) The M locus and ethylene-controlled sex determination in andromonoecious cucumber plants. Plant Cell Physiol 42:608–619

Yamasaki S, Fujii N, Takahashi, H. (2003) Characterization of ethylene effects on sex determination in cucumber plants. Sexual Plant Reprod 16:103–111

Yamasaki S, Fuuii N, Takahashi H (2003) Photoperiodic regulation of CS-ACS2, CS-ACS4 and CS-ERS gene expression contributes to the femaleness of cucumber flowers through diurnal ethylene production under short day conditions. Plant Cell Env 26:537–546

Yates, D. M., Portillo, V., & Wolstenholme, A. J. (2003). The avermectin receptors of Haemonchus contortus and Caenorhabditis elegans. *International journal for parasitology*, *33*(11), 1183-1193.

Yong, J. K., and S. Shafqat. 2003. Effect of temperature on the foraging activity of Bombus terrestris L. (Hymenoptera; Apidae) on greenhouse hot pepper (*Capsicum annuum* L.). Appl. Entomol. Zool. 38: 275–280.

Zahavi A. (2008) Ritualization and the Evolution of Movement Signals, Behaviour 72, 77–81.

Zhang, P., Wang, W. Q., Zhang, G. L., Kaminek, M., Dobrev, P., Xu, J., (2007). Senescence-inducible expression of isopentenyl alters cytokinin metabolism in cassava. J. Integr. Plant Biol. 52, 653–669.

Zhang, Z., Cui, X., Zhou, J., Huang, C., Deng, J., Tang, X., & Luo, S. (2021). Pollination of the orchid Habenaria rhodocheila by the swallowtail butterfly *Papilio helenus* in subtropical evergreen broad-leaved forests in Southern China. *Flora*, *274*.

Zhang, Y., Tan, J., Guo, Z., Lu, S., He, S., Shu, W. And Zhou, B. (2009), Increased abscisic acid levels in transgenic tobacco over-expressing 9 *cis*-epoxycarotenoid dioxygenase influence $H_2O_2$ and NO production and antioxidant defences. Plant, Cell & Environment, 32: 509-519.

Zhou, D., Kalaitzis, P., Mattoo, A. K., and Tucker, M. L. (2008). The mRNA for an ETR1 homologue in tomato is constitutively expressed in vegetative and reproductive tissues. Plant Mol. Biol. 30, 1331– 1338.

Zych, M Jędrzejewska-Szmek, K., (2013) Flower-visitor and pollen transport networks in a large city: structure and properties. Arthropod-Plant Interactions 7, 503–516