Native Honeybee Research Laboratory (NHBEE)

About us

Native Honeybee Research Laboratory (NHBEE): Deep tech researches of honeybees for multidisciplinary approach to create an invigorative economy and support resilient communities. Led by Assistant Professor Dr.Orawan Duangphakdee, NHBEE consists of 8 researchers (equivalent *2* FTEs), 1 BSc research assistant and 1 beekeeping technician. Our group, gathering from different disciplines e.g. Biology, Agricultural Technology, Biochemistry, Mathematic Modeling, Control System and Instrumental Engineering and Analytical Chemistry, works together as a team to achieve goals of NHBEE.

Since its establishment in 2008, bee research group at King Mongkut's University of Technology Thonburi (KMUTT), Ratchaburi Campus has continually enjoyed many visits and research collaborations from several foreign honeybee scientists. We have performed research activities and internationalized our bee research group in terms of actual collaborations and networking at all levels. These collaborations consist of famous senior scientists, up to 10 young Asian research scientists including Thailand and 10 others from other foreign countries e.g. Germany, U.S.A and South Africa mentoring by more than 10 honeybee senior scientists from all over the world.

The goal of the NHBEE is to become a center of excellence in research and extension of developing and implementing the utilization of native honeybees and pollinators using technological innovations that create an invigorative economy and support resilient communities in Thailand and Southeast Asia.

Our specialization is research on adaptive behavioral ecology and sociobiology in honeybees and stingless bees focusing on dance languages and signal communications. Then, we apply the integrative and multidisciplinary approaches to realization on native pollinator efficiency and beekeeping industry both for ecological and economical services. This could extend to be our 3 main distinct research areas:

I. Adaptive behaviors of bee for pollinations and ecological services
II. Economical utilization and value added products of native bees
III. Smart bee farming

Summary of Key Research

1. Bee diversity conservation and adaptation

1.1 Honeybees have a noontime break from their dancing activity

This finding showed that *Apis florea* bees largely avoid flying off between 12:00 h and 13:00 h on the one hand, and that their preferred departure angle of the sun is between 55° and 65° on the other. Given the difficulties of taking an accurate reading of the sun at angles 6° of the sun's zenith (resulting in a 1 h loss around noon) and the 2 h required to reach consensus over the final direction to be flown, the bees are simply left with two time windows, morning and afternoon, in which to abscond and, indeed some 90% of the red dwarf honeybee colonies do so (Fig 1). The noonday lull is not associated with high temperatures for any given day. Absconding is not inhibited by high temperatures. (cf. Duangphakdee et al., 2009. Journal of Insect Physiology 55: 1009-1012).

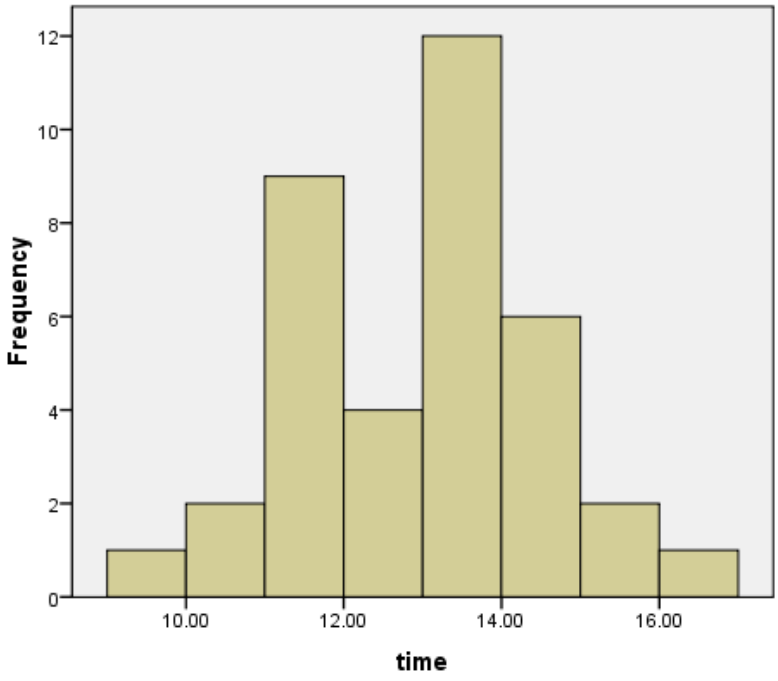

Figure 1 Frequency distribution for local clock time of absconding by *Apis florea* at Chom Bueng, Thailand (13° 59′ N, 99° 51′ E) during 2007-2009 (n=37)

1.2 Dance language in finding new nest site and foraging

Von Frisch discovered a particularly exciting facet of honeybee biology: communication by the dance language (Fig 2). Only later, when Lindauer entered the scene, did studies on Asian honeybees gain a footing. Since then, great strides have been made with respect to foraging range versus the dance tempo that shows some of the unique properties of Asian bees. Other topics include: the significance of the dance floor which differs among species, the nature of targeting food sources versus new nest sites, and the kind of information that is transmitted among worker bees. There is also the question of when to dance or not and that is firmly dependent on the azimuth of the sun. Finally, because bees fly along a changing environment, the distance measured will affect the shape of the dance curve, so that it is not possible to use any standardised calibration curve for the interpretation of dances even for the same colony (cf Duangphakdee et al. 2011. The dance language. In Honeybees of Asia, Hepburn pp. 313-332.)

Figure 2 Experienced pollen collectors in a group of dance followers that have visited the same pollen source as the dancers (picture from Tautz, 2008)

1.3 Biodiversity and conservation of honeybees and stingless bees

The geographical distribution of honeybees and stingless bees in Thailand has been studied. The distribution of four of the eleven species of honeybees of the world has been investigated and record (Fig 3). Stingless bees, of which over 500 species are found, 33 species of which are found in Thailand, are classified into five genera: *Melipona*, *Trigona*, *Meliponula*, *Dectylurina* and *Lestrimelitta. Trigona* is an extensive genus of the Meliponini tribe found in tropical regions of all continents (cf. Duangphakdee et al**.,** 2003. *Science Journal* 389-382 :57. (in Thai) and

Klakasikorn et al., 2005. *The Natural History Journal of Chulalongkorn University* 5: 1-7) and Hepburn et al., 2014, The Nest of the Honeybees: structures and functions.

Figure 3 Native honeybees of Thailand: a.) *Apis dorsata*, b.) *Apis cerana*, c.) *Apis florea*, and d.) *Apis andreniformis*.

2. Medicinal properties and biological active compounds

2.1 Ant repellent resins of honeybees and stingless bees

This study was conducted to evaluate the ant repellent affect of plant resins against weaver ants, *Oecophylla smaragdina* (Fig 4). The resins tested were the sticky bands used by the dwarf honeybees, *Apis florea* and *A. andreniformis*, propolis from the European honeybee, *A. mellifera*,

and the nest entrance tubes of the stingless bees, *Tetrigona apicalis*, *Lepidotrigona terminata*, and *Tetragonula collina*. The resins tested were highly repellent against *O. smaragdina* and could prevent most *O. smaragdina* scouts from successfully attacking bee's nests. (cf. Duangphakdee et al, 2005. Apidologie 36: 505-511; Duangphakdee et al., 2009 Insectes Sociaux 56: 333-339). Identifications of the chemical constituent of the repellent fractions are ongoing.

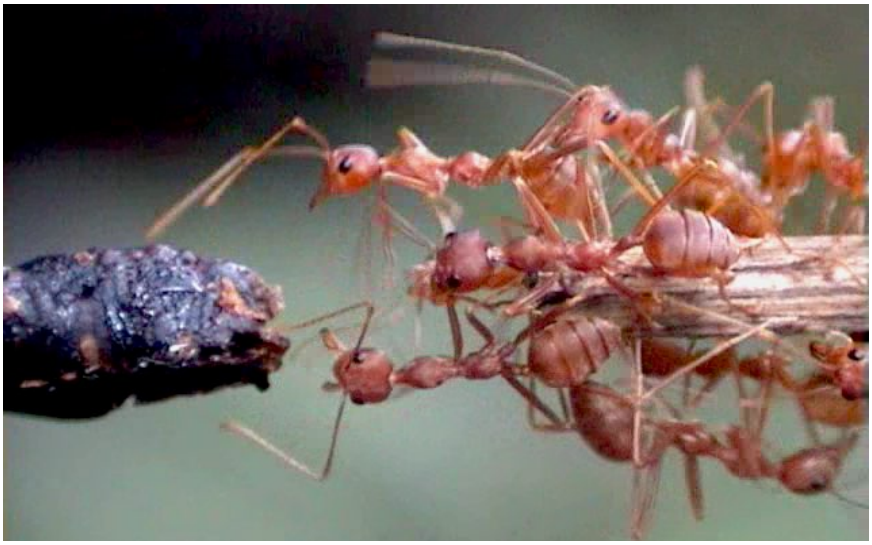

Figure 4 Weaver ants encounter the sticky band from an *A. florea* nest and do not bridge the gap.

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2.2 Antimicrobial activity and anti-cancer activity in honey and propolis from stingless bees

Antimicrobial activity for products from *T. pagdeni*, *T. laeviceps* and *T. terminata* and paper disc diffusion for products from *T. laeviceps* were tested. Honey and crude extracts of propolis were tested on *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Micrococcus aeruginosa* (gram + bacteria), *Escherichia coli* (gram - bacteria) and *Candida albicans* (yeast). The results indicate that stingless bee honey shows antimicrobial activity. The microbial inhibition efficiency varied depending on the origin of the product and the microbe species. Effective extracts were further analyzed and four chemical groups were identified: diterpenoids, triterpenoids, long chained hydrocarbons and phenol derivatives. Moreover, about eighteen compounds which were found in significant quantities in the positive fractions could not be identified by comparison to the spectra contained within the reference library.

Moreover, propolis from Thai stingless bees provided the antiproliferative activity on intestine cancer cells (Cell line SW620). The MTT assay, cell morphology and the degradation of genomic DNA results showed that propolis from Thai stingless bees contained an antiproliferative activity.

(cf. Duangphakdee et al., 2010. Research Report. Office of the National Research Council of Thailand)

3. Biodiversity integration and rural development

Absconding manipulation in *Apis cerana*

A vast majority of *Apis cerana* beekeepers in Thailand face colony absconding problems. Improving beekeeping and decreasing absconding events in *A. cerana* (Fig 5) in Thailand has been investigated, with emphasis on practical beekeeping in the buffer zone and rural areas of Western Thailand. The application of apiculture from our work has started to be appreciated in public (Fig 6) (Project is undergoing in the completion of final set of data).

Figure 5 Cavity nesting bees, *Apis cerana*

Figure 6 Transfering natural *Apis cerana* colony into a hive

Stingless bee beekeeping

Honey from stingless bees has recently become of interest because of its medicinal properties. Comparisons of honey and propolis yields from four commonly occurring species of stingless bees in Thailand (*Trigona pagdeni*, *Trigona laeviceps*, *Trigona terminata*, *Trigona fuscobalteata;* Fig 7-8) living in wooden boxes showed that the total yields, from best to worst, for honey production was *T. pagdeni*, *T. laeviceps, T. terminata* and *T. fuscobalteata*; and for propolis *T. terminata*, *T. pagdeni*, *T. laeviceps* and *T. fuscobalteata* respectively (cf. Duangphakdee et al., 2010. Research Report. Office of the National Research Council of Thailand).

Figure 7 Diversity of stingless bee nest entrances

Figure 8 Inside the nest of a stingless bee colony

Honeybee Signal Engineering and Integrated Technology

Algorithms based on collective behavior of honeybees, e.g. intelligent foraging and swarming communication behaviors with collaboration of computer engineering and control system and instrumental department has been continuously developed al follow

1) The detection and classification honey bees behaviors based on sound signal.

2) The mobile application "BeeConnex". This is a map-based virtual community for bee people consisted of interesting features eg. online sharing of farming information and experiences, alerts, consultations, food sources for bees. The app can connect bee scientists, beekeepers, bee product manufacturers, and buyers together on one place. Additionally with the offline farming management function would allow farming data records to be kept and utilize history records in optimizating quality of farm products

Increasing self-sufficiency in village apicultural practice

The projects create environmentally friendly personal care products from bee products. This will create sustainable and rewarding markets for honeybee products (honey, beeswax and propolis) (Fig 9) and other by-products (Fig 10) with value for the rural community in Kao Cha-ngum, Pho Tharam, Ratchaburi, Thailand.

1) The production of bee products (honey and propolis) for household use.
2) Farmers' economic improvement (income from sale of bee products and processed environmentally friendly products) is valued at approximately 5,000 baht/month (Fig 11).
3) The symbiotic economic relationship of endemic honeybees (pollination of crops) and crops (bee forage/food).

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Figure 10 Honeybee product from Kao Cha-ngum village

Figure 11 Presentation of personal care honeybees products by the daughter of the farm owner.

Community Engagement & Workshop

The Bee cooperation: Native Thai Beekeeping Network

1. Rakangthong, Kao Cha-ngum, Potharam, Ratchaburi

(Unifloral, Multifloral Honey) – Contracted Farmer

2. Kampangsan

3. Nhong Phai

4. Lab-Lao, Chumporn

5. Makham, Chantaburi

6. Donkratai, Nakorn Pratom

7. Thai Beekeeping Association: Chaingmai/Lumpun/Lumpang

8. Mlabri Hill tribes

9. Chongsarika, Lopburi

10. Sai Yok, Kanchanaburi

Workshops

1. Micro-beekeeping to support the invigorative economy and create ecological services in community

2. Beeswax soap making and bee products development workshop

Honeybee Published Practices

1. **Publications:**

BOOKS

1. Wongsiri, S., Deowanish, S. and Duangphakdee, O. 2008. *Honeybees and Honey*. Chulalongkorn University Press, Bangkok. (In Thai)

2. Duangphakdee, O., Hepburn, H.R. and Tautz, J. 2011. The dance language. In Honeybees of Asia, Hepburn, H.R. and Radloff, S., Eds. Spinger-Verlag Berlin Heidelberg, pp. 313-332.

https://link.springer.com/chapter/10.1007%2F978-3-642-16422-4_14

3. Phiancharoen, M., Duangphakdee, O. and Hepburn, H.R. Biology of nesting. 2011. In Honeybees of Asia, Hepburn, H.R. and Radloff, S., Eds. Spinger-Verlag Berlin Heidelberg, pp.109-132

https://link.springer.com/book/10.1007/978-3-642-54328-9

4. Hepburn, H.R., Pirk, C.W.W. and Duangphakdee, O. (Eds). 2014. The Nest of The honeybees: Structure and Functions. Spinger-Verlag Berlin Heidelberg 389 pp. http://www.springer.com/us/book/9783642543272

RESEARCH ARTICLES

1. Duangphakdee, O., Wongsiri, S., Lekprayoon, C., Deowanish, S. and Chanchao, C. 2003. Diversity and the distribution of *Apis florea*, *A. andreniformis*, *A. dorsata*, *A. cerana* and *A. mellifera* in Thailand. *Science Journal* .389-382 :57 (in Thai)

2. Duangphakdee, O., Koeniger, N., Koeniger, G., Wongsiri, S. and Deowanish, S. 2005. Reinforcing a barrier-a specific social defense of the dwarf honeybee (*Apis florea*) released by the weaver ant (*Oecophylla smaragdina*). *Apidologie* 36: 505-511. https://hal.inria.fr/hal-00892159/document

3. Klakasikorn, A., Wongsiri, S., Deowanish, S. and Duangphakdee, O. 2005. New record of stingless bees (Meliponini: *Trigona*) in Thailand. *The Natural History Journal of Chulalongkorn University* 5: 1-7.

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4. Hepburn, H.R., Radloff, S., Duangphakdee, O. and Phiancharoen, M. 2009. Interspecific utilization of wax in comb building by honeybees. *Naturwissenschaften*. 96: 719-723

https://link.springer.com/article/10.1007%2Fs00114-009-0517-x

5. Duangphakdee, O.*, Koeniger,N., Deowanish, S., Hepburn, H.R. and Wongsiri, S. 2009. Ant repellent resins of honeybees and stingless bees. *Insectes Sociaux* 56: 333-339.

https://link.springer.com/article/10.1007/s00040-009-0027-z

6. Duangphakdee, O.*, Radloff, S.E., Pirk, C.W.W. and Hepburn, H.R. 2009. Sun angle time windows for absconding by the dwarf honeybee, *Apis florea.* Journal of Insect Physiology 55: 1009-1012.

http://www.sciencedirect.com/science/article/pii/S0022191009002662

7. Hepburn, H.R., Duangphakdee, O., Phaincharoen, M. and Radloff, S.E. 2010. Comb wax salvage by the red dwarf honeybee, *Apis florea*. Journal of Insect Behavior 23: 159-164

https://link.springer.com/article/10.1007%2Fs10905-010-9205-0

8. Pirk, C.W.W., Crous, K.L. and Duangphakdee, O., Radloff, S.E. and Hepburn, H.R. 2011. Economics of comb wax salvage by the red dwarf honeybee, *Apis florea*. Journal of Comparative Physiology B 181: 353 – 359.

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9. Duangphakdee, O.*, Radloff, S.E., Pirk, C.W.W., Hepburn, H.R. 2011. Waggle Dances and Azimuthal Windows. Psyche (doi:10.1155/2011/318985)

https://www.hindawi.com/journals/psyche/2011/318985/

10. Duangphakdee, O.*, Hepburn, H.R., Radloff, S.E., Pirk, C.W.W., Rod-im, P. and Wongsiri, S. 2012. Waggle dances in absconding colonies of the red dwarf honeybee, *Apis florea*. *Insectes Sociaux* 59: 571-577

https://link.springer.com/article/10.1007/s00040-012-0254-6

11. Hepburn, H.R., Duangphakdee, O. and C.W.W. Pirk, 2013. Physical Properties of honeybee silk: A review. *Apidologie* 44: 600-611 (DOI 10.1007/s13592-013-0209-6)

https://link.springer.com/article/10.1007/s13592-013-0209-6

12. Rattanawannee, A., Duangpukdee, O*. and Poolprasert, P. 2013. Insect Diversity during different stages of Asiatic Elephant Dung deterioration in Eastern Thailand. The Kasetsart Journal: Natural Science, KURDI, Kasetsart University 47 : 387 – 397

http://kasetsartjournal.ku.ac.th/kuj_files/2013/A1308131340069218.pdf

13. Laomettachit, T., Termsaithong, T., Sae-Tang, A. and Duangphakdee, O. 2015. Decision – making in honeybee swarms based on quality and distance information of candidate nest sites. Journal of Theoretical Biology 364: 21–30.

http://www.sciencedirect.com/science/article/pii/S0022519314005438

14. Rattanawannee, A., Phankaew, C., Duangpakdee, O., Rod-im, P. and Hepburn, H.R. 2015. Discrimination of two *Tetragonula* (Apidae: Meliponini) Complex Species in Thailand using Geometric Morphometric Analysis of Wing Venation The Kasetsart Journal: Natural Science, KURDI, Kasetsart University 49: 700-710

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15. Rod-im, P., Duangpukdee, O*., Radloff, S., Hepburn, C., C.W.W. Pirk and Hepburn, H.R. 2015. Azimuth-dependent waggle dances; flight and foraging activities of the red dwarf honeybee, *Apis florea* Fabricius (1787). Journal of Apicultural Research 54, No. 3, 246–254

http://www.tandfonline.com/doi/abs/10.1080/00218839.2016.1151631?journalCode=tjar20

16. Laomettachit, T., Termsaithong, T., Sae-Tang, A. and Duangphakdee, O. 2016. Stop-Signaling Reduces Split Decisions without Impairing Accuracy in the Honeybee Nest-Site Selection Process. Journal of Insect Behavior. 1-21 (DOI: 10.1007/s10905-016-9581-1)

https://link.springer.com/article/10.1007/s10905-016-9581-1

17. Rattanawannee, A., Jeratthitikul, E., Duangpakdee, O. and Oldroyd, B.P. 2017. Molecular genetics and geometric morphometrics suggest at least two clades in the

Tetragonilla collina Smith, 1857 (Apidae: Meliponini) population of Thailand. Apidologie (DOI: 10.1007/s13592-017-0517-3).

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18. Wongsa, K., Rattanawannee, A. and Duangpakdee, O. 2017. Genetic Structure of the *Aphis craccivora* (Hemiptera: Aphididae) From Thailand Inferred From Mitochondrial *COI* Gene Sequence. Journal of Insect Sciences Jul; 17(4): 84.

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19. Jamnongchob, A., Duangphakdee, O. and Hanpattanakit, P. 2017. CO_2 emission of tourist transportation in Suan Phueng Mountain, Thailand. Energy Procedia 136 (2017) 438–443.
http://www.sciencedirect.com/science/article/pii/S1876610217352505
20. Panyamang, A., Duangphakdee, O. and Rattanawannee, A. 2018. Genetic structure of teak beehole borer, Xyleutes ceramicus (Lepidoptera: Cossidae), in northern Thailand. Agriculture and Natural Resources (Accepted).

Research Grants and Sponsored Projects

2007-2008 **Title:** Keeping Multiple Queens of *Apis cerana* Colonies to Increase Honey Yields

Source: Research Network (Lower Middle part of Thailand) of Commission on Higher Education

Investigator: Mananya Phiancharoen, Orawan Duangphakdee, Preecha Rod-im

Grant amount: 326,250 THB

2009-2010 **Title:** The Study of Stingless Bee Keeping for Medicinal Honey Production and The Biologically Active Compounds from it's Products.

Source: Annual Government Statement of Expenditure

Investigator: Orawan Duangphakdee, Mananya Phiancharoen, Preecha Rod-im

Grant amount: 559,000 THB

2009-2011 **Title:** Absconding mechanisms and the involved pheromones of the red dwarf honeybee, *Apis florea* Fabricius, 1787.

Source: Thailand Research Fund (New Researchers Grant)

Investigator: Orawan Duangphakdee

Grant amount: 480,000 THB

2011 **Title:** Honeybee Village

Source: Science and Technology Village Projects, Ministry of *Science and Technology*

Investigator: Mananya Phiancharoen, Orawan Duangphakdee, Preecha Rod-im, Supawadee CHompupan

Grant amount: 242,000 THB

2011-2014 **Title**: The Study of Biodiversity, adaptation and Living Factors of Native Honeybees in Thailand

Source: National Research University Project of Thailand's Office of the Higher Education Commission

Investigator: Mananya Phiancharoen, Orawan Duangphakdee

Grant amount: 1,400,000 THB

2012 **Title**: Process Development for the Production of Virgin Coconut Oil and Honey Based Lip Balm and Skin Care Lotion

Source: Research Network (Lower Middle part of Thailand) of Commission on Higher Education

Investigator: Orawan Duangphakdee, Preecha Rod-im

Grant amount: 150,000 THB

2012 **Title**: Climatic cycle migrations of giant honeybees, *Apis dorsata* at their home Phung trees, *Ficus albipila* and *Kompassia malaccensis*

Source: The Asahi Glass Foundation (AGF)

2014 **Title**: The development of value-added honey and products from native honeybees in Thailand

Source: National Research University Project of Thailand's Office of the Higher Education Commission

Investigator: Orawan Duangphakdee, Preecha Rod-im, Amnat Chidthaisong

Grant amount: 200,000 THB

2013-2014 **Title**: The development of beekeeping with the red dwarf honeybee, *Apis florea* for economy and physicochemical characteristics of its' honey

Source: Annual Government Statement of Expenditure

Investigator: Orawan Duangphakdee Maruj Limpawattana Oraphin Chantarasriwong, Thitima Wongshiri, Preecha Rod-im

Grant amount: 778,000 THB

2014-2015 **Title** Influence of seasonal variation on total phenolic, antioxidant and antibacterial activities of natural honey in Ratchaburi, Thailand

Source: KMUTT Research Funding 2014

Investigators: Kanteera Soontharapirakkul, Orawan Duangphakdee, Preecha Rod-Im

Grant amount: 200,000 THB

2015-2016 **Title** Genetic diversity of *Apis dorsata* aggregation on Phung tree, *Ficus albipila* at Tanawsri mountain range, Thailand based on microsatellites

Source: KMUTT Research Funding 2015-2016

Investigators: Nongnat Phoka, Orawan Duangphakdee, Preecha Rod-im, Pimpisa Jansamut

Grant amount: 200,000 THB

2015 - 2016 **Title** The Production of Unique Honeys from Herbal Edible Flowers and Development for Commercially Product

Source: Annual Government Statement of Expenditure

Investigators: Orawan Duangphakdee, Preecha Rod-im, Kanteera Soontharapirakkul, Nongnat Phoka, Panutda, Yodsang, Oraphin Chantarasriwong, Maruj Limpawattana

Grant amount: 893,700 THB

2015 - 2016 **Title** Process Development for the Products of Honey, Bee wax and Rice Brand Oil Based Soap, Shampoo and Skin Care Lotion

Source: Annual Government Statement of Expenditure

Investigator: Nongnat Phoka**,** Orawan Duangphakdee, Preecha Rod-im

Grant amount: 145,000 THB

2015 **Title** The Development of Apiary Management, Product Value-Added and Bee Hive Monitoring System for Beekeeping in Thailand
Source: National Research University Project
Investigator: Orawan Duangphakdee, Panuthat Boonpramuk, Preecha Rod-im**,** Teeraphan Laomettachit, Kanteera Soontharapirakku, Nongnat Phoka

Grant amount: 350,000 THB

2015 **Title**: Bee cooperation

Source: Nawawiwat Company Limited

Investigator: Orawan Duangphakdee /Preecha Rod-im

Grant amount: 300,000 THB

2015 – 2016* **Title:** Landscape management of floral resources for beekeeping and pollination in integrated farming system
Source: Betagro Public Company Limited

Investigator: Orawan Duangphakdee, Preecha Rod-im**,** Punpaporn Kongkaew

Grant amount: 805,000 THB

2016* **Title** Landscape Management of Floral Resources for Beekeeping in Cavity Nesting Honeybees (*Apis cerana*) and Honey Aromatic Profile Analysis by Gas Chromatograph-Mass Spectrometer *(GC/MS*)
Source: National Research University Project
Investigator: Orawan Duangphakdee, Preecha Rod-im, Suvaluk Asavasanti, Winyu Chitsamphandhvej Panuthat Boonpramuk Teeraphan Laomettachit Panutda Yodsang

Grant amount: 362,700 THB

2016-2017* Practical Native Beekeeping Training for Mlabri in Phufa, Bo Kluea, Nan Provices and the Signature Profile and Physicochemical Property Determination of Honey Produced
Source: NSTDA

Investigator: Orawan Duangphakdee, Preecha Rod-im, Suvaluk Asavasanti, Winyu Chitsamphandhvej**,** *Norachat* Wongwandee**,** Panutda Yodsang

Grant amount: 484,000 THB

2016* **Title**: The Physicochemical Characteristics and Biologically Active Compounds of Unique Unifloral Honey from Aromatic Plants

Source: Annual Government Statement of Expenditure
Investigator: Kanteera Soontharapirakkul, Orawan Duangphakdee, Preecha Rod-Im

Grant amount: 297,550 THB

2016 – 2017* **Title:** Development of Honey Production Technique and the Technology Transfer for Beekeeping in Integrated Farming System

Source: Annual Government Statement of Expenditure
Investigator: Preecha Rod-im
Grant amount: 466,620 THB

2016 – 2017* **Title:** A Stochastic Model of Honeybee Colony's Infection via Trophallaxis

Source: Thailand Research Fund
Investigator: Teeraphan Laomettachit

Grant amount: 443,000 THB

2017 * **Title**: The Effect of Land Use Change and Honey Hunting on The Giant Honeybees, *Apis dorsata*, Population Dynamics on Phung trees, *Ficus albipila* and the at Tanawsri Mountain Range, Thailand

Source: Annual Government Statement of Expenditure
Investigator: Orawan Duangphakdee
Grant amount: 426,500 THB

2017 * **Title:** Diversity of Mycorrhizal Fungi Community in *Ficus albipila* of Tanowsri Mountain range, Ratchaburi and Prachuap Khiri Khan Province

Source: Annual Government Statement of Expenditure
Investigator: Panutda Yodsang
Grant amount: 506,100THB

Partnership

Research network: local and international

Selected intensive collaboration by co-researchers, co-author in publications and co-supervision under graduated and graduated students)

1	Prof. Dr. Siriwat Wongsiri	Academic Affair, Maejo University, Thailand
2	Assoc. Prof. Dr. Chanpen Chanchao	Department of Biology, Faculty of Sciences, Chulalongkorn University, Thailand
3	Asst. Prof. Dr. Atsalek Rattanawannee	Department of Entomology, Faculty of Agriculture, Kasetsart University, Thailand
4	Mr. Chan Chooprasit	Chairman of Thai Beekeeping Association, Thailand
5	Assoc. Prof. Dr. Maruj Limpawattana	epartment of Food Technology, Faculty of Science, Siam University, Thailand
6	Miss Sangdaw Daodung	Member of Subdistrict Administrative Organization, Thailand
7	Prof. Dr. Randall Hepburn	Department of Zoology and Entomology, Rhodes University, South Africa
8	Prof. Dr. Sarah Radloff	Department of Statistics, Rhodes University, South Africa
9	Assoc. Prof. Dr. Christian W.W.W. Pirk	Department of Zoology and Entomology, University of Pretoria, South Africa
10	Prof. Dr. Jurgen Tautz	Bee Group, Biozentrum, Biozentrum Universität Würzburg Am Hubland, Germany
11	Dr. Catherine Sole	Department of Zoology and Entomology, University of Pretoria, South Africa
12	Prof. Dr. Nikolaus Koeniger	Institute of Binenkunde, JW Goethe-Universität Frankfurt am Main, Germany

13	Dr.Gudrun Koeniger	Institute of Binenkunde, JW Goethe-Universität Frankfurt am Main, Germany
14	Mr. Salim Tingek	Agricultural Research Station, Tenom, Malaysia
15	Mr. Herbert Lim	Agricultural Research Station, Tenom, Malaysia
16	Dr. Yang Ming-Xian	Zoology Department Sichuan Agricultural University, China
17	Prof. Dr. Deborah Smith	University of Kansas, USA University of Sydney Queen Mary University of London University of Hohenheim, Germany
1 8 .	Dr. James Makinson	Department of Biological and Experimental Psychology, School of Biological and Chemical Sciences, Queen Mary University of London
1 9 .	Dr. Franziska Harich	Universityof Hohenheim, Germany
2 0 .	Prof. Dr. Tan Ken,	Key Laboratory of Tropical Forest Ecology, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Science, Kunming, 650223 China
2 1 .	Associated Prof. Dr. Yong-Chao Su	Dept. of Biomedical Science and Environmental Biology Kaohsiung Medical University, Taiwan

Mentoring & Awards

NHBEE members got individual awards from several national and international institutions as follows:

- The Asahi Glass Foundation Award (2012)

- The Outstanding Research Presentation Award, 12nd The Meeting of TRF

- New Researchers Meet Senior Researchers, 10-12 October 2012, Holiday Inn Resort Regent Beach Cha-am, Petchaburi, Thailand

- KMUTT rising star young researcher award 2017

- Internet of Things (IoT) innovation 2017 (2nd place)

Members

Core members and expertise

Competency / Expertise	
The Group as a whole	Developing and implementing the integrative and multidisciplinary approaches to realization of ecological, economical and technological innovations in beekeeping for high quality bee products and pollination services.
O Duangphakdee	1. Living factors and adaptation in honeybees and pollinators
P Yodsang, N Phoka	2. Genetic diversity and bioactive compounds of bee products
W Chitsamphandhvej	3. Honey Fingerprints and aromatic compounds in bee products
P Boonpramuk,	4. Smart technology in beekeeping and pollination services
T Laomettachit, T Termsaithong	5. Modeling and algorithms based on honeybee behavior
P Rod-im	6. Beekeeping for rural development and pollination practices

Honeybee products

Honey Fingerprint and High Quality Bee products

Research of biologically active substances and development of high quality honey and proprolis consists of 2 themes 1) Investigation for biologically active substances and medicinal properties in bee products 2) Development of production protocol and technologies into innovative for the honey fingerprint properties related to the herbal bee flora.

Native Honeybee Research Laboratory has been helping the beekeepers in the rural area in terms of beekeeping techniques and related knowledge that benefits beekeeping procedure. The beekeepers eventually produce fingerprint and high quality honey which are launched into the market with gross profit margin. We currently have 3 types of honey under BEESANC name as follows:

Apis florea

This natural, light and floral wildflower honey is collected throughout the rural organic farms in Thailand which are the research field sites of the Native Honeybee Research Laboratory (NHBEE) of King Mongkut's University of Technology Thonburi (Ratchaburi). The NHBEE initiated the first *Apis florea* beekeeping in those farms and has made major breakthrough. This then makes the honey become the main source of income for the poor in the areas. The uniqueness of this honey is sweet-scent and heavenly taste from natural flower nectar. The research papers conducted by the NHBEE also found the concentrated antioxidants which could stop cancer growth.

Stingless bee

Honey from Stingless bee has high medicinal properties in healing and keeping consumers healthy. This is due to the composition of the concentrated propolis in honey. The research indicated that Stingless bee honey could help control the growth of microorganism and it has around 3-6 times antioxidants more than those found in other kinds of honey. The laboratory test results also revealed that antioxidants could halt cancer growth and force some cancer cells to self-destruct.

Apis dorsata

The eco-friendly and effective honey collecting by the help of NHBEE make Mlabri tribe can produce a wonderful product like a tailor-made honey in unique flavor which is gathered from the organic farms in Nan province, Northern Thailand. According to the laboratory tests, Mlabri's honey is rich in vitamin C and antioxidants that could prevent or delay cell damage.

BeeConnex

BeeConnex is an extracurricular course taught at the Residential College, King Mongkut's University of Technology Thonburi, Ratchaburi by Native Honeybee Research Laboratory. This course aims at empowering and encouraging the students in the campus who are interested in social enterprise business plan. The learning outcomes of the course include business model canvas which students have to be able to identify key partners, key activities, key resources, value propositions, customer segments, customer relationships, marketing channels, cost structure and revenue streams.

BeeConnex is also a business model of honeybee signal engineering and smart beehive monitoring system

Algorithms based on collective behavior of honeybees, e.g. intelligent foraging and swarming communication behaviors with collaboration of computer engineering and control system and instrumental department has been continuously developed al follow

1) The smart hive monitoring system for detection and classification honey bees behaviors based on sound signal and dance communication. The automated bee hive monitoring system will speed up the processes and enhance management techniques in the beekeeping industry by reducing time and labor costs. Using this new approach, bees will be significantly less disturbed during examinations and can also alarm beekeepers of major abnormal incidences.
2) The mobile application “BeeConnex”. The map-based virtual community for bee people consisted of interesting features e.g. online sharing of farming information and experiences, alerts, consultations, food sources for bees which will connect bee scientists, beekeepers, bee product manufacturers, and buyers together on one place. Additionally with the offline farming management function would allow farming data records to be kept and utilize history records in optimizing quality of management of bee farm and yielding farm products