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ที่พบในประเทศไทย

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ULTRASTRUCTURE AND PHEROMONES OF THE MANDIBULAR GLANDS
OF HONEYBEE FORAGERS IN THAILAND

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กันทิมา สุวรรณพงศ์ : อัลตราสตรักเจอร์และเฟอร์โมนของต่อมแม่นดิบูลาร์ในกลุ่มผึ้งงานที่หากาหารที่พบในประเทศไทย (Ultrastructure and Pheromones of the Mandibular Glands of Honeybee Foragers in Thailand) อ. ที่ปรึกษา : ศ.ดร.สิริวัฒน์ วงศิริ , อ. ที่ปรึกษาร่วม : Prof.Dr. Randall Hepburn; 177 หน้า. ISBN 974-346-164-7

อัลตราสตรักเจอร์ของต่อมแม่นดิบูลาร์ในกลุ่มผึ้งงานที่หากาหารในประเทศไทย “ได้รับยังด้วยกล้องจุลทรรศน์แบบส่องกล้อง (SEM; JSM 5410 LV) พบร่องรอยแต่ละร่างของผึ้ง *Apis andreniformis* ผึ้ง *A. florea* และผึ้ง *A. dorsata* มีจำนวน 2 ปุ ตั้งอยู่ที่ส่วนฐานของกรามแต่ละร่าง สำหรับผึ้ง *A. cerana* และผึ้ง *A. mellifera* มีร่างละ 1 ปุ พบนัยน์ท่อลมเล็กๆ แทรกอยู่ที่ด้านข้างของต่อมในผึ้งทุกชนิด พบร่องรอยเชือกพันคลุมตัวต่อม แต่ไม่พบการเชื่อมโยงของไขประสาท ขนาดของต่อมแตกต่างกัน โดยมีขนาดเส้นผ่านศูนย์กลางด้านกว้าง 182, 225, 553, 422, 515 ไมโครเมตร และขนาดเส้นผ่านศูนย์กลางด้านยาว เป็น 217, 341, 644, 512 และ 607 ไมโครเมตร ในผึ้ง *A. andreniformis* ผึ้ง *A. florea* ผึ้ง *A. dorsata* ผึ้ง *A. cerana* และผึ้ง *A. mellifera* ตามลำดับ นอกจากนี้ยังได้ศึกษาในรายละเอียดของต่อมแม่นดิบูลาร์ในกลุ่มผึ้งงานที่หากาหานี้ ด้วยกล้องจุลทรรศน์แบบส่องผ่าน (TEM; JEOL 200SX) พบร่องรอยรังโดยทั่วไปคล้ายกันและจัดเป็นต่อมชนิด tubulo alveolar ประกอบด้วยเซลล์สามชนิดคือ เซลล์ชนิดที่ 1 เป็นเซลล์รูปร่างถูกบากๆ นิวเคลียสกลม ในรูปร่างผู้บริโภคตัวตันของต่อม เซลล์ชนิดที่ 2 เป็นเซลล์ร้อมติดสีเข้ม อยู่ติดติดกับเซลล์ชนิดที่ 3 ซึ่งเซลล์ชนิดที่ 3 เป็นเซลล์ที่ร้อมติดสีขาว ตั้งอยู่ล้อมรอบและบรรจบกันของต่อม ขนาดของเซลล์แต่ละชนิดแตกต่างกัน โดยขนาดใหญ่สุดพบในผึ้ง *A. dorsata*, *A. mellifera*, *A. cerana*, *A. florea* และ *A. andreniformis* ตามลำดับ พบร่องรอยคลุมตัวต่อมในผึ้ง *A. mellifera* ชัดเจน ในขณะที่ไม่ปรากฏในผึ้ง *A. dorsata*, *A. cerana*, *A. florea* และ *A. andreniformis*.

จากກากวิเคราะห์สาร 2-heptanone ในต่อมแม่นดิบูลาร์ ในกลุ่มผึ้งงานที่หากาหาร โดยเครื่องแก๊สไฮโรไฟฟ์ (GC-Hewlett 5890 series II) และเครื่องแก๊สไฮโรโนมิกไทร์ (GC-MS Saturn Varian 4D) พบระบวน 0.205, 0.425, 1.322 และ 7.076 ไมโครกรัมต่อตัว ในผึ้ง *A. andreniformis* ผึ้ง *A. dorsata* ผึ้ง *A. cerana* และผึ้ง *A. mellifera* ตามลำดับ ไม่พบเบนโซอล 2-heptanone ในผึ้ง *A. florea* การวิเคราะห์ชนิดของสารที่เป็นองค์ประกอบหลักของเฟอร์โมนของต่อมแม่นดิบูลาร์ในผึ้งกลุ่มดังกล่าว พบร่องสารที่เป็นองค์ประกอบหลักคือ 1-eicosanol เป็นสารที่มีคุณสมบัติในการดึงดูดซักนำผึ้งตัวอื่น และพบสาร 70% ของสารที่เป็นองค์ประกอบหลัก 10 ชนิดของผึ้งทั้ง 5 species เป็นสารที่รักกันอยู่ 7 ชนิด แต่มีสัดส่วนของสารแต่ละชนิดแตกต่างกัน ได้แก่ 2-butyl-1-octanol, dibutyl phthalate, eicosane, 1-eicosanol, heneicosanol, 2-hexyl-1-decanol และ nonadecane ส่วนในกลุ่มผึ้งพื้นเมืองทั้ง 4 species พบร่องสารที่เป็นองค์ประกอบหลักเป็นสารที่รักกันอยู่ 8 ชนิด แต่มีสัดส่วนที่แตกต่างกัน ได้แก่ 1-butanol-3-methyl acetate, 2-butyl-1-octanol, dibutyl phthalate, eicosane, 1-eicosanol, heneicosanol, 2-hexyl-1-decanol และ nonadecan.

ภาควิชา ชีววิทยา

สาขาวิชา วิทยาศาสตร์ชีวภาพ
ปีการศึกษา 2543

ลายมือนิสิต.....
ลายมืออาจารย์ที่ปรึกษา.....
ลายมืออาจารย์ที่ปรึกษาร่วม.....



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ULTRASTRUCTURE

GUNTIMA SUWANNAPOONG: ULTRASTRUCTURE AND PHEROMONES OF THE MANDIBULAR GLANDS OF HONEYBEE FORAGERS IN THAILAND.

THESIS ADVISOR: PROF. SIRIWAT WONGSIRI, Ph.D. THESIS-COADVISOR: PROF. RANDALL HEPBURN, Ph.D. 177 pp. ISBN 974-346-164-7

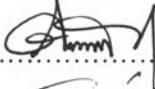
The ultrastructure of the mandibular glands of honeybee foragers in Thailand were investigated by using SEM (JSM 5410 LV) showed that they are divided into two groups: two pair of lobed glands which are found in *A. andreniformis*, *A. florea* and *A. dorsata*, and one pair of lobed glands which are found in *A. cerana* and *A. mellifera*. These glands are associated with a dense net of tracheoles and covered by connective tissue; however, no nerve ending can be observed. In addition, average gland sizes are 182, 225, 553, 422 and 515 μm in width, and 217, 341, 644, 512 and 607 μm in length of *A. andreniformis*, *A. florea*, *A. dorsata*, *A. cerana* and *A. mellifera*, respectively. The ultrastructure of these glands using TEM (JEOL-200CX) showed that the secretory glands are tubulo-alveolar glands. Each gland is composed of three cell types. The type I cell is composed of aggregated cuboid cells with lenticular nucleus, locate at the proximal part of glands. The cell type II are electron dense staining cells, which are composed of rich mitochondria, smooth endoplasmic reticulum and various vesicles. These cell types are located beneath the cell type I and adjacent to cell type III or electron light staining cells which contain few mitochondria and enlarged vesicles. These two cell types surround the central reservoir. However, the extra organelles, large dark granules, are found distributed randomly only in cytoplasm of cell type III of *A. mellifera* foragers.

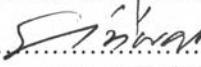
The mandibular gland pheromones of honeybee foragers in Thailand were analyzed by using gas chromatography (GC-Hewlett 5890 series II) and gas chromatography mass spectrometry (GC-MS Saturn Varian 4D). The level of 2-heptanone in *A. andreniformis*, *A. dorsata*, *A. cerana* and *A. mellifera* are 0.205, 0.425, 1.322 and 7.076 $\mu\text{g}/\text{bee}$, respectively. However, it was undetectable in *A. florea*. The main components of mandibular gland pheromones of *A. andreniformis*, *A. florea*, *A. dorsata*, *A. cerana* and *A. mellifera* are 1-eicosanol which act as attractant pheromones. The ten main components of mandibular gland pheromones are homologous for 70% of the chemicals with different proportions: 2-butyl-1-octanol, dibutyl phthalate, eicosane, 1-eicosanol, heneicosanol, 2-hexyl-1-octanol and nonadecane. Furthermore, 80% homology of ten main components with different proportions are found among native honeybee species: 1-butanol-3-methyl acetate, 2-butyl-1-octanol, dibutyl phthalate, eicosane, 1-eicosanol, heneicosanol, 2-hexyl-1-octanol and nonadecane.

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Guntima Suwannapong

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