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Melissopalyonology of Multifloral Honey of Asian Giant Honeybee, *APIS DORSATA* Fabricius At Southern Karnataka, India

KEYWORDS: Pollen analysis, multifloral honey, Apis dorsata, southern Karnataka

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ABSTRACT *Field observations were conducted during the years 2010 and 2011 to collect honey from Asian giant honeybee, Apis dorsata Fabricius (Hymenoptera: Apidae: Apoidae) colonies by following standard methods amidst arid, semi-arid and malnad regions of southern Karnataka. Altogether, 48 pollen types were recorded. Of all, 43 pollen types belonged to medicinal plants (19 species), economically important plants (eight species), fruit yielding plants (seven species), vegetables (six species), ornamental plants (three species) and remaining five types were unidentified. Thus, pollen analysis in the honey collected from A. dorsata colonies revealed multifloral characteristics. The honey contained various types of pollen grains with different shape and structure. Different pollen grains represented specific flowering plant species. A. dorsata is a voracious forager, collect nectar and pollen from diversified flora and produce multifloral honey useful to mankind. Understanding its floral source would help reveal floral status of the region and knowledge on pollen types would provide a greater insight into Melissopalyonology of that region.*

Introduction

Asian giant honeybee, Apis dorsata Fabricius (Hymenoptera: Apidae: Apoidae) is one of the voracious foragers, known for its high nectar and pollen gathering potential from various plants. While foraging on the flowers, A. dorsata worker bees collect nectar and pollen grains also. Later, these pollen grains become part of honey, vital constituents for the identification of floral sources of the region. The microscopic analysis of pollen is one of the standard methods, effective tool to understand the distribution and abundance of floral sources for the honeybee species. Ramanujam et al. (1992), Sivaram (1995), Lakshmi and Suryanarayana (1997), Bera et al. (2007), Bhusari et al. (2007), Bhargava et al. (2009), Shilpa and Ratan (2011) have reported on pollen analysis of honey from different parts of India. Since, A. dorsata travel to a wider area (e.g. more than three kilometers) in search of forage, pollen analysis in the honey, greatly helps to understand the geographical and botanical origin, Unifloral and Multifloral characterisitcs of honey as well. However, such type of studies exclusively on A. dorsata is meager, and little is known about Melissopalyonology of A. dorsata honey from southern Karnataka. Melissopalyonology is one of the methods used to identify the type of pollen present in the honey (Maurizio, 1951; Sawyer, 1975), widely used as quality control tool and to ascertain whether honey is adulterated or not (Maurizio, 1951; Louveaux et al., 1978; Molan, 1998; Terrab et al., 2003). In this context, there is a fairly even distribution of information on floral source to A. dorsata in southern Karnataka. Therefore, the present investigation was undertaken.

Materials and Methods

Field observations were conducted during the years 2010 and 2011, met honey hunters for the collection of honey from A. dorsata colonies at different regions of southern Karnataka. Qualitative analysis of honey was conducted to identify the pollen types by dilution method as per Erdtman (1956) and Bibi et al. (2008). Collected honey was diluted by adding 50 ml double distilled water and four dilutions namely 0.5, 1.0, 1.5 and 2.0 ml were prepared as per Erdtman (1956). The prepared samples were centrifuged at 2,500 rpm for 15 minutes. The supernatant was decanted. The sediment was again dispersed in 10ml distilled water and centrifuged at 2,500 rpm for another 15 minutes and repeated twice in order to separate the pollen present along with the sugar and to clear the pollen grains for good visibility. Then, the sediment was added with distilled water to make up the content one milliliter. A minimum of five samples from this solution were subjected to acetolysis before microscopic examination. Pollen acetolysis was made by using one ml of concentrated Sulphuric acid and nine ml of acetic anhydride as per the method of Erdtman (1956). Finally, pollen grains were stored at 1% Safranine stain mixed with glycerin jelly. Different type of pollen grains were observed under microscope and photographed with the help of Canon-Power Shot S21S, 8.0 Mega Pixels Digital Camera with 12X Optical Zoom and identified with the help of standard keys.

Results

Pollen analysis: The pollen types recorded from honey collected from A. dorsata normal colonies is depicted in Figures 1 and 2. Altogether, 48 pollen types were recorded. Of all, 43 pollen types belonged to medicinal plants (19 species), economically important plants (eight species), fruit yielding plants (seven species), vegetables (six species), ornamental plants (three species) and remaining five types were unidentified. The Ocimum tenuiflorum, Hibiscus rosa-sinensis, O. canum, Azadiracta indica, Bidens pilosa, Lantana camera, Riccinus communis, Eucalyptus globules, E. tereticornis, Leucas aspera, Adhatoda zeylanica, Evolvulus alsinoides, Acacia nilotica, Madhuca longifolia, Caseaaria elliptica, Cassia occidentallis and Phyllanthus, Albizia and Acacia species are enlisted as medicinal plants and their pollen types are depicted in Figures 1 and 2. The economically important plants pollen types (e.g. Coffea arabica, Cocos nucifera, Helianthus annus, Borassus flabellifer, Zea mays, Thespesia populnea, Elaeocarpus and Bombax species), fruit yielding plants pollen types (e.g. Citrus medica, Syzigium cumini, Carica papaya, Psidium guajava, Tamarindus indica, Mangifera indica and Phoenix sylvestris) vegetable plants pollen types (e.g. Capsicum fruitescens, Moringa oleifera, Cucurbita pepo, Mormordica

Volume : 4 | Issue : 8 | August 2014 | ISSN - 2249-555X

charantia, Cucumis sativus and Solanum sp.) and ornamental plants pollen types (e.g. Millingtonia hortensis, Croton and Mimosa species) are depicted in Figures 1 and 2. All these foraging plant belong to Mimosaceae, Cucurbitaceae, Caesalpinaceae, Rutaceae, Malvaceae, Myrtaceae, Anacardiaceae, Euphorbiaceae, Verbenaceae, Asteraceae, Meliaceae, Solanaceae, Acanthaceae, Bignoniaceae, Rubiaceae, Araceae, Convolvulaceae, Elaeocarpaceae, Flacourtiaceae, Bombaceae, Palmae, Sapotaceae, Icacinaceae and Poaceae families.

Discussion

Different geographical regions of southern Karnataka have good potential for various flowering plants and showed 3.256 to 3.864 Shannon-Wiener Diversity Index (H^1) (Raghunandan, 2014). These plants bloom during different months of the year and few species bloom throughout the year (Basavarajappa, 2012; Raghunandan, 2014). As, good floral source is one of the key factors, decide and determine the A. dorsata colonies distribution, analyzing pollen contents in the honey could reveal locally available bee flora that would become a ready rockner to the people who are involved in apiculture.

Pollen is important constituents of the honey, microscopic analysis help identify different types of pollen grains with specific shape and size. It is one of the effective tools to understand the distribution, abundance, geographical and botanical origin as well. Data from the figures 1 and 2 clearly demonstrated the presence of various types of pollen grains with different shape and structure. Each pollen type represented the specific plant species that could reveal the floral status of this region. Thus, honey from the A. dorsata colonies collected at southern Karnataka revealed multifloral characterisitcs. Maurizio (1951), Sawyer (1975) has identified different pollen types in the honey collected from Brazil. Since, pollen analysis is used as one of the quality control tools to ascertain whether honey is adulterated or not (Maurizio, 1951; Louveaux et al., 1978; Molan, 1998; Terrab et al., 2003). During the present investigations, no such adulteration incidences were recorded because tested honey was collected from the natural colonies of A. dorsata in the wild. Similar type of reports were published by Ramanujam et al. (1992), Sivaram (1995), Lakshmi and Suryanarayana (1997), Bhusari et al. (2007), Bera et al. (2007), Bhargava et al. (2009), Shilpa and Ratan (2011). Our results agree with the observations of previous reports.

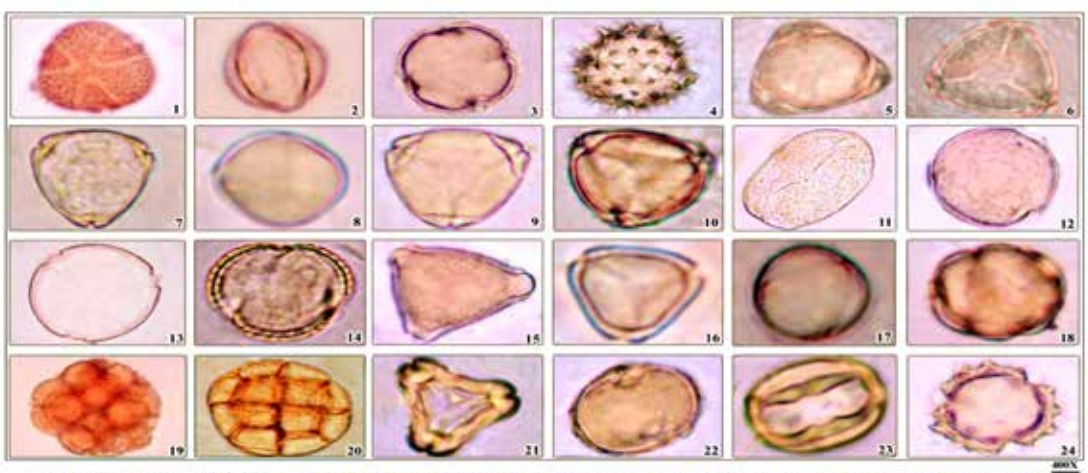

Figure 1. Photomicrographs of pollen types identified in multifloral honey of *Apis dorsata* in southern Karnataka

1. *Ocimum tenuiflorum*, 2. *Eleocarpus* sp. 3. *Citrus medica*, 4. *Hibiscus rosa-sinensis*, 5. *Eucalyptus globulus*, 6. *Millingtonia hortensis*, 7. *Psidium guajava*, 8. *Ocimum canum*, 9. *Syzigium cumini*, 10. *Carica papaya*, 11. *Croton* sp. 12. *Leucas aspera*, 13. *Cassuria elliptica*, 14. *Bombax* sp. 15. *Phyllanthus* sp. 16. *Coffea Arabica*, 17. *Solanum* sp. 18. *Evolvulus alsinoides*, 19. *Acacia* sp. 20. *Acacia* sp. 21. *Eucalyptus tereticornis*, 22. *Adhatoda zeylanica*, 23. *Azadiracta indica*, 24. *Tamarindus indica*.

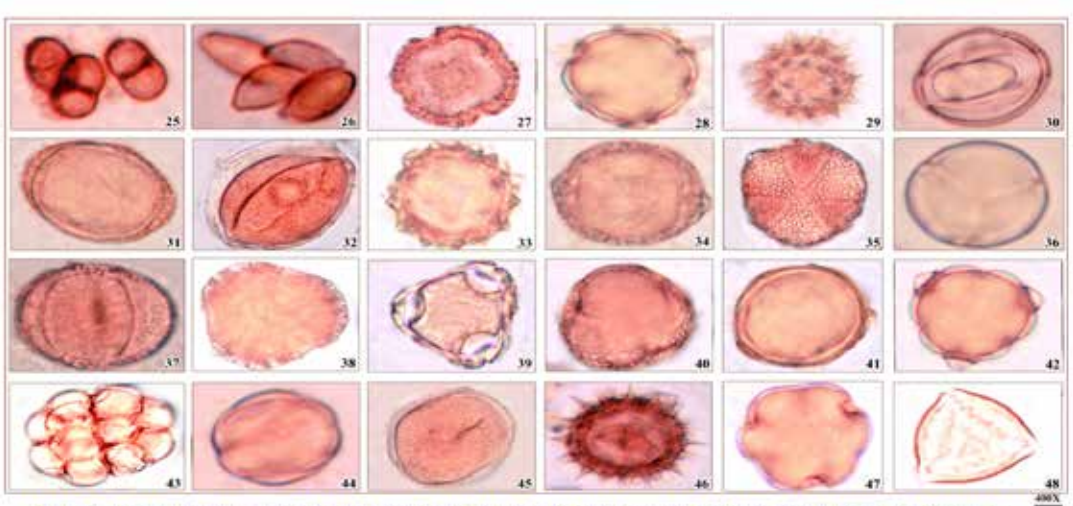

Figure 2. Photomicrographs of pollen types identified in multifloral honey of *Apis dorsata* in southern Karnataka

25. *Tamarindus indica*, 26. *Poaceae*, 27. *Mangifera indica*, 28. *Madhuca longifolia*, 29. *Helianthus annus*, 30. *Borassus flabellifer*, 31. *Euphorbiaceae*, 32. *Cocos nucifera*, 33. *Thespesia populnea*, 34. *Moringa oleifera*, 35. *Momordica charantia*, 36. *Mimosa* sp. 37. *Rutaceae*, 38. *Caesalpinaceae* sp. 39. *Capsicum frutescens*, 40. *Cucurbita pepo*, 41. *Zea mays*, 42. *Cucumis sativus*, 43. *Albizia* sp. 44. *Cassia occidentalis*, 45. *Phoenix sylvestris*, 46. *Balem pilosa*, 47. *Ricinus communis*, 48. *Lantana camera*.

Volume : 4 | Issue : 8 | August 2014 | ISSN - 2249-555X

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