BIOINDICATOR SYSTEM FOR THE MONITORING AND DETERMINING OF HONEY HARVESTING CALENDAR FOR HONEY GATHERERS OF THE ASIATIC GIANT HONEYBEE (*A. DORSATA*)

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Introduction

Honey hunting is a unique and attractive ecotour item in the rainforest reserve of Pedu Lake, Kedah. There can be as many as 120 bee colonies nesting in aggregates on a single, emergent bee tree. One of the fascinating feature of this sedentary and aggregating bee colonies is the behaviour of mass defecations during hot days as a mechanism to dispense heat load (Kevan and Mardan, 1990; Mardan 1994). During the honey harvesting season, honey gatherers with their clan climb the bee tree and cut honeycombs filled with honey, using traditional technique of using incantation, glowing embers with special containers and knife (Mardan et al. 1983). Promoting honey harvesting of the Giant honeybee in the Pedu Lake rainforests is a fraught with the risk of unpredictable arrival and absconding of the Giant honeybees from the bee tree, thus disappoints many.

Honey gatherers, ecotour operators, promoters, hoteliers, etc. have no control on the arrival and absconding of the Giant honeybee swarms thus they have no control on the happening of the honey harvesting event. It requires pre determination of harvesting dates for ease of ecotourists to watch the spectacular honey harvesting event. Attempts to promote honey-gathering activity for ecotourism is fraught with many difficulties which include the problem of determining of the exact dates of honey harvest in advance of 2-3 months ahead of the honey harvesting event. Ecotourists need to book their holidays in advance in order to facilitate hotel reservation, ticketing, etc. A mechanism or technique is required to provide predictable, reliable determination of the honey harvesting event in order to promote the ecotour product (honey harvesting) as tourist attraction and destination. This project was focused to procure the relevant body of knowledge on a set of bioindicator-monitoring system or the development of a reliable a honey-harvesting calendar guide for honey-gatherers of the Asiatic Giant honeybee (*A. dorsata*) and ecotour activities.

Materials and Methods

Data gathering through observation, monitoring and analysis were carried out to identify the level of relatedness and dependence between the associated factors of the flora-fauna, biophysical, physical and bee species-specific traits. Phase 1: The observation and analytical studies involved a tremendous hours of observation on the arrival and absconding of *A. dorsata* colonies at their nesting tree, inter-related species interaction, degree of association or dependency between the related species (predation, parasitism, commensalism, symbiosis, etc.). The intensive observational studies were either quantified or qualitatively evaluated in terms of ranking data in order to generate a quantifiable data for analysis. Phase 2: To find a correlation between the flora and fauna that are related to the bees, we determine the degree of relationship and its dependency between them are either ranked as predator, parasite, symbiosis, commensalism or happenstance. His data is important to consider whether the species is very critical to the either the faunistic or floristic web of the honeybees. Phase3: Once the data have been collected and analysed they are then illustrated in a food chain order of the bee ecology web in interactive multimedia and organisation of a seminar to tourists at the Desa Utara Resort at Pedu Lake.

Results and Discussion

A set of biological (brood patch size, foraging activity, presence of natural enemies, etc.), physical (lunar calendar, monsoons rains, water source, etc.) and biophysical environmental factors were identified as criteria for the determination and monitoring of the Asiatic Giant honeybee ripeness for honey harvesting. Associated flora-fauna species that are inextricably-linked to the sedentary Giant honeybees during the December-to-March season are, viz. Man, bear, flying squirrels, several species of birds (honey buzzard (*P. apovirus*), bee eaters (*Merops* spp.), Black-thigh falconnet, honeyguide, etc.), bats, moths (wax moths (*G. melonella*) hawkmoths, wasps, Dipterans, mites (*T.clarea*), bacteria, virus, etc. Their associations with the Giant honeybees on the bee trees were established and merit to be considered as bioindicators for the determination of colony ripeness for harvest. Whereas, biophysical factors that lends great influence on the abundance, arrival and absconding of bee swarms, brood emergence, pre-season and monsoons rains, lunar activity, water foraging bees, floral blooms, nectar and pollen. A temporal, telltale and bee ecology web and food-chain was developed for the bioindicator system for honey-gathering activity for the honey-gatherers.

Conclusions

A technique for the determination of method of honey-harvesting time was developed for honey-gatherers to participate in the ecotour promotion activities with the Kedah State Government. Several products on interactive multimedia courseware, drone-mating software, floral calendar, honey-gathering websites, ecotour activities, seminar, video documentary (Turner Broadcasting Corporation), radio (National Public/National Geographic Society), publications, were produced from this study.

References

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