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# Nest Dispersion of a Stingless Bee Species, *Trigona collina* Smith, 1857 (Apidae, Meliponinae) in a Mixed Deciduous Forest in Thailand

**TOUCHKANIN JONGJITVIMOL[1*], KAMOLPORN BOONTAWON[1], WANDEE WATTANACHAIYINGCHAROEN[1] AND SUREERAT DEOWANISH[2]**

[1] *Department of Biology, Faculty of Science, Naresuan University, Phitsanulok 65000, THAILAND.*
[2] *Department of Biology, Faculty of Science, Chulalongkorn University, Bangkok 10330, THAILAND.*

**ABSTRACT.– Nest dispersion of a stingless bee species; *Trigona collina* Smith, 1897 was investigated during January 2004 to June 2004. The study area was in a mixed deciduous forest at Phitsanulok Nature Education Center, Phitsanulok, Thailand. In total, the distribution of forty-seven colonies of *T. collina* was studied. The results of standardized Morisita index of dispersion within the area studied showed that the nest dispersion of the *T. collina* is a strongly clumped distribution ($p < 0.05$). The pattern of nest dispersion in this species probably ensures an adequate number of mates in their mating range.**

**KEY WORDS:** nest dispersion, stingless bees, *Trigona*, *T. collina*

## INTRODUCTION

Stingless bees (Apidae, Meliponinae) live socially in perennial colonies of a few hundred up to several thousand individuals (O'Toole & Raw, 1999). Stingless bee species are very diverse with about 400 species found throughout the world (Velthuis, 1997). A large numbers of species have been reported in tropical areas, of which 23 species have been reported in Thailand (Sakagami et al., 1990; Michener & Boongird, 2004). This study observed the *T. collina* because they are common species in the north of Thailand, and they play an important role in the pollination of economic crops and wild plants. They are, therefore, important in forest ecosystems. Dispersion of a certain species is certainly species specific, and that specific pattern must give a benefit to the species. Furthermore, differences in nest dispersion may result from diversity in those ecosystems. The aim of this work was to study the nest dispersion of stingless bee; *T. collina* in a mixed deciduous forest at Phitsanulok Nature Education Center, Phitsanulok, Thailand.

*Corresponding author:
E-mail: jongjitvimol_t@hotmail.com

## MATERIALS AND METHODS

A mixed deciduous forest at Phitsanulok Nature Education Center, Phitsanulok, Thailand was chosen as the study site, during January 2004 to June 2004. The methods of line transect and random sampling were used in the survey for sample collection. Using a Global Positioning System (GPS) receiver, the precise location of each nest was mapped using the ArcView GIS

(Krebs, 1999) to determine patterns of nest dispersion.

The obtained data were analyzed by using Morisita's index of dispersion ($I_d$). The studied parameters were sample size ($n$), sum of the quadrat counts ($\sum x$), and sum of the quadrat counts squared ($\sum x^2$)

The following formula was used:

$$I_d = n\left[\frac{\sum x^2 - \sum x}{(\sum x)^2 - \sum x}\right]$$

However, results obtained from Morisita's index of dispersion are difficult to interpret. Therefore, the standardized Morisita's index was calculated, a following:

Uniform index; $M_u = \dfrac{\chi^2_{0.975} - n + \sum x_i}{(\sum x_i) - 1}$

Clumped index; $M_c = \dfrac{\chi^2_{0.025} - n + \sum x_i}{(\sum x_i) - 1}$

where: $\chi^2_{0.975}$ = value of chi-squared from the table with (n-1) degrees of freedom that has 97.5% of the area to right

$\chi^2_{0.025}$ = value of chi-squared from the table with (n-1) degrees of freedom that has 2.5% of the area to right

$x_i$ = given a set of counts of organisms in a set of quadrats

$n$ = no. quadrats

Then we calculated a standardized Morisita's index by one of the following four formulas:

When: $I_d \geq M_c > 1.0, I_p = 0.5 + 0.5\left(\dfrac{I_d - M_c}{n - M_c}\right)$

$M_c > I_d \geq 1.0, I_p = 0.5\left(\dfrac{I_d - 1}{M_u - 1}\right)$

$1.0 > I_d > M_u, I_p = -0.5\left(\dfrac{I_d - 1}{M_u - 1}\right) I_p$

$1.0 > M_u > I_d, I_p = -0.5 + 0.5\left(\dfrac{I_d - M_u}{M_u}\right)$

The standardized Morisita's index of dispersion ($I_p$) ranges from -1.0 to +1.0 with 95% confidence limits at +0.5 and -0.5, where $I_p = 0$ in random dispersion, $I_p > 0$ in clumped dispersion and $I_p < 0$ in uniform dispersion.

## RESULTS

We found forty-seven colonies of *T. collina*. The results of the standardized Morisita index of dispersion ($I_p$) of *T. collina* was a strongly clumped distribution ($I_p = 0.636$) at a 95% confidence level (Fig. 1).

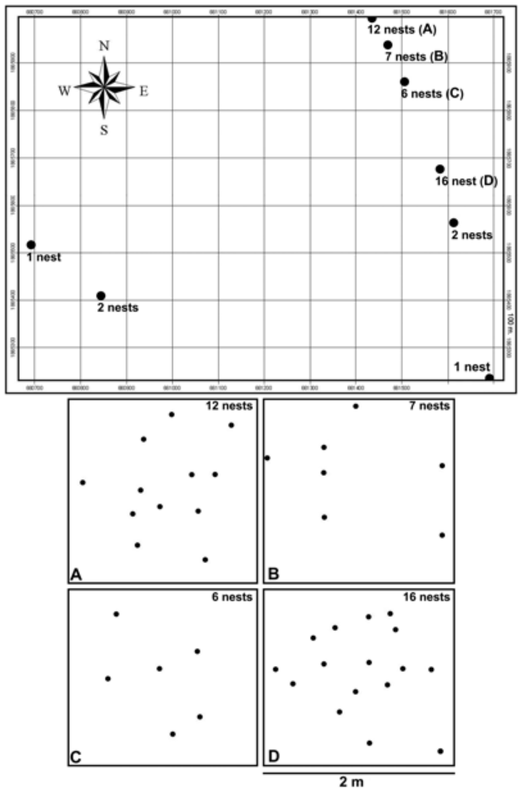


**FIGURE 1.** The locations of *T. collina* colonies in a mixed deciduous forest in Thailand were mapped using the ArcView GIS 3.2 program.

## DISCUSSION

This study deals with the dispersion of *T. collina* in a mixed deciduous forest. The nest dispersion of *T. collina* had a strongly clumped distribution ($p < 0.05$).

Nest dispersion of *T. collina* is a clearly clumped dispersion. This pattern of nest dispersion causes aggregation of nests in a certain area. Nest aggregation in honey bees cause risks to those species such as acquiring pests and disease due to overlapping foraging ranges (Rinderer, et al., 2002). In the stingless bee, *T. collina*, microsatellite analysis revealed that colonies within aggregations were not related (Cameron et al., 2004). This suggested that they try to minimize the chance of inbreeding and maximize the probability of increasing genetic variance in progeny produced (Palmer & Oldroyd, 2000). The benefits gained from aggregation of unrelated colonies are possibly higher than any risk the colonies may face when they are aggregated.

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