Ceratina nigrolateralis - Small Carpenter Bee

*Ceratina nigrolateralis* (Cockerell 1916)
(Hymenoptera: Apidae: Ceratinini)

Figure 1. *Ceratina nigrolateralis* on *Melastoma malabathricum*. Image courtesy of © Zestin Soh.

Introduction

Noticed only by the sharp-eyed, *Ceratina nigrolateralis* is a tiny bee with a glossy black and yellow body, often seen foraging alone on a wide variety of flowers. The most commonly-found member of the 10 or more species of *Ceratina* in Singapore, *Ceratina nigrolateralis* is an important generalist pollinator that can be found in both forested areas and near urban areas.

It would therefore come as a great surprise to know that the tiny members of the genus *Ceratina* are some of the closest relatives of the large carpenter bees of the genus *Xylocopa*, some of the largest bees in Asia. The Xylocopinae subfamily of Apidae includes both *Xylocopa* from the Xylocopini tribe and *Ceratina*, the only genus in the Ceratinini tribe. This despite the largest size of members of *Ceratina* to be only approximately a third the size of a *Xylocopa*.

Though *Ceratina* are much less studied, the genus consists of 23 subgenera and are found in all continents. More than 45 species have been found in Southeast Asia, with the 10 or more species in Singapore representing five out of seven regional subgenera. Despite their value as pollinators, knowledge about Southeast Asian *Ceratina* only began to develop more quickly in the 2000s and specific information about *C. nigrolateralis* remains limited.

This page therefore aims to shed light upon *Ceratina nigrolateralis*, a species native to Singapore. The author hopes that this page will be useful towards enthusiasts, biology students and those seeking a more comprehensive understanding of the biology and ecology of this species.

Morphology
The Xylocopinae subfamily of Apidae constitutes bees with diverse sizes and appearances. From the large carpenter bees of the genus Xylocopa from the tribe Xylocopini to the small carpenter bees of the related genus Ceratina, Ceratina, however, are much smaller and more slender, coming to no more than 8mm in length in comparison to Xylocopa which can grow to more than 20mm in length (Figure 2).

Though members of the genus are usually associated with metallic blue and green coloration, various subgenera, such as Ceratinidia, are characterized by strong black and yellow colors. Ceratina nigrolateralis is a member of the Ceratinidia subgenus which is easily differentiated from other common subgenera, generally, by their extensive yellow markings (Figure 3).
Figure 4. Identifying characteristics of *C. nigrolateralis* © 2016 K. Chang. (i) scutum (ii) scutellum (iii) T1 tergite (iv) scape (v) space between eyes (vi) clypeus (vii) angular projection of coxa (viii) midleg

At a deeper level, *C. nigrolateralis* can be recognized via the pattern and density of punctuation on the scutum (Figure 4i) and between the eyes (Figure 4v). Distinctive yellow markings are observable on the scutellum (Figure 4ii) and clypeus (Figure 4vi). The antennal scape are dark or black (Figure 4iv) and the T1 tergite has a reduced yellow marking compared to other species that forms a spot in the center (Figure 4iii). *C. nigrolateralis* also has a strong lateral angular projection of the front coxa (Figure 4vii) and a distinctly colored midleg (Figure 4viii). Due to the approximately 7mm size of *C. nigrolateralis*, a microscope or magnifying glass may be required to view certain characteristics.

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**Nesting**
Species Interactions

Pollination and Agriculture

Video: Ceratina foraging on long-bracted spiderwort. Source: Youtube

*Ceratina* are generalist pollinators which visit a diversity of plants and crops (polylectic), carrying their pollen on their hind legs (see Figure 1). As they nest within dry stems and twigs and thrive on flowers near nests sites, they have been demonstrated to have potential for domestication and have been shown to successfully increase crop yield. Due to the benefits of using native species as crop pollinators, they have potential agricultural significance.

Parasites
Mites within the *Sennertia* genus (Acari: Chaetodactylidae) have been associated with Xylocopinae for an extended period \(^{10,11}\). It was suggested that the cleptoparasites kill young bees in brood cells and feed on pollen provisions \(^{12}\). This has been debated, with other authors bringing forth the possibility that the mites do not kill the brood as they develop within the cells \(^{13}\). Warrit (2007) \(^{14}\) confirmed the observation of *Sennertia* mites on *Ceratinidia* specimens.

### Distribution

#### Singapore

The species has been found in almost every different habitat available in Singapore, from the managed greenery within the urban National University of Singapore (NUS) campus to the Central Catchment nature reserve (CCNR). Records have been made in almost every nature and community park in Singapore and from scrubs near urban landscapes. Specimens have even been collected from among the Jurong subcoastal scrubs \(^{15}\).

#### Southeast Asia
C. nigrolateralis is distributed throughout Southeast Asia (Figure 8). Records of species and subspecies have been found from Taiwan to Bali, Indonesia.

Taxonomy and Phylogeny

Taxon navigation

Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Hymenoptera
Superfamily: Apoidea
Family: Apidae
Subfamily: Xylocopinae
Tribe: Ceratinini
Genus: Ceratina
Subgenus: Ceratinidia
Species: nigrolateralis

Taxon description and revisions
The species was originally described by Cockerell, in 1916, as a subspecies of *Ceratina philippinensis*, *Ceratina philippinensis nigrolateralis* (Figure 9). The female holotype is located within the British Museum of Natural History. Van der Vecht, who was the first to review Southeast Asian *Ceratina*, redescribed *Ceratina nigrolateralis* as a species and proceeded to provide a key to various subspecies. Following this, the species has had at least three major synonyms, *Ceratina acuticauda*, *Ceratina incerta* and *Ceratina corbetti*. Warrit et al. (2007) revised the subgenus *Ceratinidia* in his dissertation and in 2012, treated most Southeast Asian species in a revision of Thai *Ceratinidia*. Shiokawa (2015) later revised the *compacta* species group of *Ceratinidia*. At present, *C. nigrolateralis* has 6 recognized subspecies, of which *Ceratina nigrolateralis incerta* is the form with a type locality in Singapore and is the subspecies inferred in this page.

**Integrated Taxonomy**

The use of integrated taxonomy, the combination of both genetic and morphological data to sort out species relationships has become increasingly applied and important. A barcoding project using 313bp of COI was conducted on morphologically identified Singaporean and Southeast Asian *Ceratina* species. Although a 3-4% difference is usually expected between species, up to 11.9% pairwise differences could be observed between species of *Ceratina*, which is very large even with species from different subgenera, while at a subspecies level, *Ceratina nigrolateralis incerta* and *Ceratina nigrolateralis corbetti* were found to have identical barcodes while *Ceratina nigrolateralis incerta* and *Ceratina nigrolateralis acuticauda* were 6.4% different. The use of both morphology and genitalia are therefore still very relevant, in addition to DNA, as tools in the delimiting of species.

**Phylogeny**
Figure 10. Consensus phylogram from Bayesian Inference (BI) analysis with posterior probability support indicated for all nodes. Adapted from Rehan et al., 2010. Subgenera are shown on the right and the red box highlights the Ceratinidia subgenus with C. nigrolateralis highlighted. Nodes with less than 75% support are highlighted in yellow.

The Bayesian inference consensus (figure 10) has a generally high branch support. The authors relied on this tree for the recovering of phylogenies, the data was partitioned into 6 parts and run in MrBayes. The tree shows the highest support at the subgenus level but may be less resolved otherwise. Within subgenera, strong support is generally observed with the exception of a few nodes within Neoceratina, Ctenoceratina, Zandontomerus, Ceratinaul and Ceratinidia. However, between subgenera, support can drop lower, as seen from supports as low as 54% between Megaceratina and other Ceratina clades, 48% between Zandontomerus and Calloceratina and 42%, which is observed between Copoceratina and Ceratina. In addition, the authors also had a Maximum Parsimony bootstrap consensus tree (that was not used to recover phylogeny), with bootstrap supports at similar nodes showing percentage supports that were as low as 10%. A possible reason for the lack of certainty could be a result of the low number of genes used to generate the tree, only two mitochondrial genes, COI and Cytb were used in addition to one nuclear gene, EF1alpha. The authors found that there were higher rates of cladogenesis closer to the origin of each tribe which corresponded to major dispersal events that lead to the extant subgenera.

References


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Last curated in 2017