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THE HONEY BEES OF INDONESIA (HYMENOPTERA: APIDAE)

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ABSTRACT

A brief account is provided for the native and introduced species of honey bees (Apini: *Apis* L.) occurring across Indonesia. Keys to the tribes of corbiculate bees and the species of the genus *Apis* are provided to aid melittologists and apiculturists working in the country.

Key words: Apoidea, Anthophila, Apinae, honey bees, *Apis*, identification keys

INTRODUCTION

Among the diversity of around 20,000 species of bees worldwide, the honey bees (genus *Apis* Linnaeus) are the most heavily researched and managed, focusing the efforts of thousands of researchers and tens of thousands of apiculturists. However, in terms of bee diversity, *Apis* accounts for only seven living species (Engel 1999) or 0.035% of that remarkable diversification. Honey bees are one of four living tribes of corbiculate apine bees. The lineage of corbiculate bees comprises the orchid bees (Euglossini Latreille), bumble bees (Bombini Latreille), stingless bees (Meliponini Lepeletier de Saint Fargeau), and the honey bees (Apini Latreille) in the modern fauna (Engel 2001a, 2005, Michener 2007), as well as the extinct tribes Electrobombini Engel, Electrapini Engel, and Melikertini Engel (Engel 2001a, 2005), the latter representing the presumed sister group of the meliponines (Engel 2001a, 2001b). All of these lineages are highly eusocial with the exceptions of the primitively eusocial Bombini and Electrobombini, and the communal or solitary Euglossini.

While today the honey bees are restricted to the Old World, and with only a single species occurring in Europe (*Apis mellifera* Linnaeus) and considerably reduced diversity in Africa (*A. mellifera* and *A. florea* Fabricius), during the relatively recent geological past the genus was much more widespread and included Western North America (Engel *et al*. 2009), and even regions such as Europe had multiple species and exhibited dramatically greater morphological disparity (*e.g*., Kotthoff *et*

al. 2011). Also, lineages which today are more restricted had greater geographic distributions (*e.g*., *Megapis* species in Iki Island of the Korea Strait: Engel 2006). Indeed, during the Oligocene and Miocene, the area with greatest *Apis* diversity was Europe (Engel 1998, Kotthoff *et al*. 2011). It is within Southeast Asia that honey bees today exhibit their greatest diversity both at and below the species level. Indeed, at times this diversity has seemed overwhelming and Maa (1953) recognized as many as 24 species within the genus, although more modern treatments have paired this plethora considerably (*e.g*., Engel 1999, Radloff *et al*. 2011, Ruttner 1988). Surprisingly, despite the remarkably intense scrutiny that has been applied to *Apis* diversity in Asia, few truly systematic works exist and world or regional keys have been lacking or difficult to access by most (*e.g*., Engel 2001c, 2002, Malaipan 1972). Maa's (1953) keys remain the only dichotomous means of recognizing the world's taxonomic units for honey bees, although revised treatments are underway (Engel in prep.).

Herein I provide an identification key to those species of honey bees known to occur, both natively as well as from introduced species, across Indonesia. Indonesia harbors natively five of the seven known species and a remarkable breadth of variation within those species. Accordingly, I have tailored the colors used in the key to reflect the ranges observed within Indonesia and provided brief notes on the occurrence of those species within the country, all as an aid for apiculturists working in the country. The introduced Western Honey Bee (*A*. *mellifera*) is included so as to aids its differentiation from the native species. Introduction of *A*. *mellifera* has been attempted several times over the last 150 years but only intensified during the last 20–25 years mostly as the result of commercial efforts. Fortunately, many of these have failed but Indonesian apiculturists should be aware of *A*. *mellifera* and encouraged to continue to cultivate, even on larger industrial scales, their native species over this European form. In addition, I include a key to the three living tribes of corbiculate bees similarly known to occur in the region and in the hope of stimulating study of these groups by local researchers. Such materials are being published in advance and coordination of ongoing work related to the world diversity of honey bees (Engel in prep.). Morphological terminology used throughout is based on the more standard systems as applied to all bees (and, in most cases, to all Hymenoptera) (Engel 2001a, Michener 2007), rather than the more regional or specialised terms sometimes employed by apiculturists but which in some cases are erroneous or misleading. The classification of species adopted is that of Engel (1999), although some researchers prefer to elevate regionally distinctive forms to specific rank despite its concomitant implications for the circumscription of the related forms (*e.g*., refer to Radloff *et al*. 2011). Recent and relevant

biological accounts of the various honey bees may be found in Oldroyd & Wongsiri (2006), Koeniger *et al*. (2010), and Hepburn & Radloff (2011), as well as references cited in these works.

Key to the Tribes of Corbiculate Bees in Indonesia

Within Indonesia, three of the four living tribes of corbiculate bees are known to occur. Honey bees (Apini) and stingless bees (Meliponini) occur throughout the country, while only five species of bumble bees (Bombini) are known from the western parts of Indonesia (Sumatran region).

1. Jugal lobe of hind wing present; metatibial spurs absent; arolia present; outer grooves of mandible absent 2
—. Jugal lobe of hind wing absent; metatibial spurs present; arolia absent or considerably reduced and vestigial; outer grooves of mandible present (bumble bees) ..... Bombini
2. Forewing with reduced distal venation, marginal cell frequently open at apex; pretarsal claws simple; penicillum present in worker; auricle absent; sting reduced (stingless bees) .....Meliponini
—. Forewing with complete distal venation, marginal cell long and completely bordered by strong tubular veins; pretarsal claws cleft; penicillum absent in worker; auricle present; sting well developed and barbed (honey bees) ..... Apini

Key to the Species of *Apis* in Indonesia

1. Distal abscissa of vein M in hind wing present (Fig. 1A) 2
—. Distal abscissa of vein M in hind wing absent (Fig. 1B) 5
2. Forewing hyaline (Fig. 2A); mesoscutellum yellow-brown, rarely black; drone with tarsi unmodified; worker size moderate, forewing length 7–9 mm; cavity-nesting species 3
—. Forewing fuscous (Fig. 2B); mesoscutellum black; drone with dense frond-like setae on meso- and metatarsi (Fig. 2C); worker size large, forewing length 12–15 mm; open-nesting species ..... *A. dorsata* Fab.
3. Coloration variable but typically clypeus dark grey, antennal scape dark brown to black, legs dark brown to black, and body setae ranging from grey to tan or silver; drone cell cap with pore 4
—. Clypeus rusty, antennal scape rusty, legs more rusty to reddish brown, and body setae rather reddish tan; drone cell cap without pore; Indonesia (Sulawesi) and Philippines (Mindanao) only…….. ……*A. nigrocincta* Sm.
4. Coloration not as below; widespread ..... *A. cerana* Fab.
—. Coloration largely rubescent, rubiginous (reddish brown) to rufo-testaceous (reddish yellow), sometimes light testaceous on basal

leg podites; Malaysia, Brunei, and Indonesia (Sumatra, Java, Kalimantan) only ..... *A. koschevnikovi* End.

5. Mesoscutellum black; drone with metabasitarsal process; worker size small, forewing length 6–7 mm; open-nesting species …..... 6

—. Mesoscutellum light to dark brown; drone without metabasitarsal process; worker size moderate, forewing length 7.5–10 mm; cavity-nesting species ..... *A. mellifera* L.

6. Metatibia and dorsolateral margin of metabasitarsus with black setae; metasomal terga I and II black to dark reddish brown, infrequently with reddish brown tints apically on tergum I or basally on tergum II (Fig. 3A); drone metabasitarsal process short, less than one-half metabasitarsus length (Fig. 3B) ..... *A. andreniformis* Sm.

—. Metatibia and dorsolateral margin of metabasitarsus with white setae; metasomal terga I and II reddish orange to reddish brown (Fig. 3C); drone metabasitarsal process long, more than two-thirds metabasitarsus length (Fig. 3D) (Java only) ..... *A. florea* Fab.

Figure 1. Hind wings of representative *Apis* species depicting presence or absence of distalmost abscissa of vein M (arrow): (A) Hind wing of worker of *Apis cerana* Fabricius, (B) Hind wing of worker of *A. mellifera* Linnaeus. Images not to same scale; jugal lobes at base of wings folded under (typical of many dried specimens)

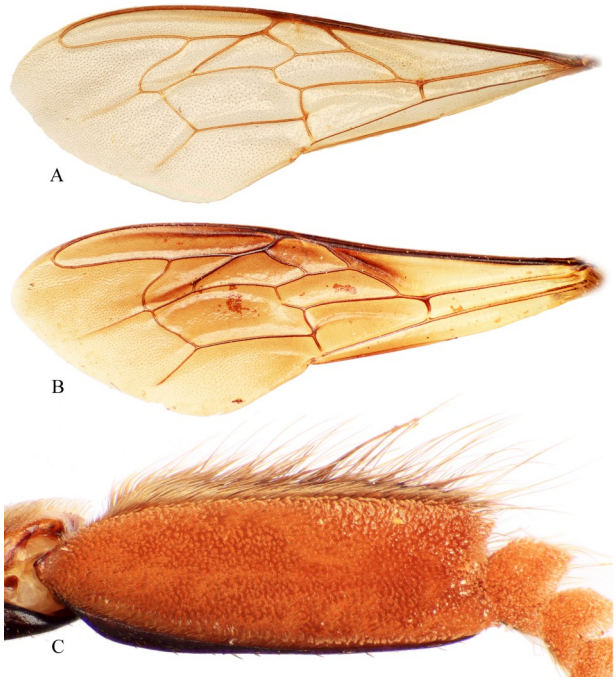

Figure 2. Details of *Apis* s.str. and *Megapis*: (A) Forewing of worker of *Apis mellifera* Linnaeus, (B) Forewing of worker of *A. dorsata* Fabricius, showing extensive areas of dark infuscation, (C) Inner surface of drone metabasitarsus of *A. dorsata*. Images not to same scale

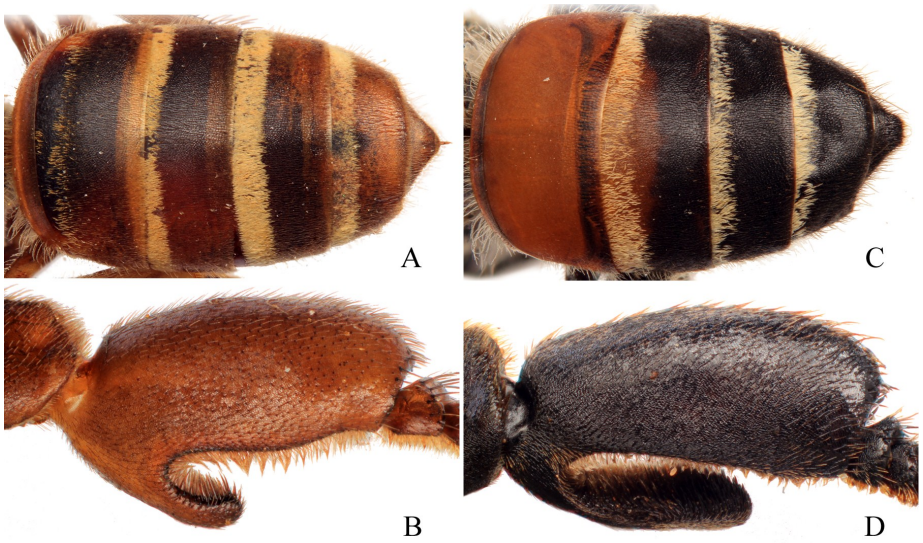

Figure 3. Differences between species of *Micrapis*: (A) Dorsal view of metasoma of worker of *Apis andreniformis* Smith, (B) Outer surface of drone metabasitarsus of *A. andreniformis,* (C) Dorsal view of metasoma of worker of *A. florea* Fabricius, (D) Outer surface of drone metabasitarsus of *A. florea*. Images not to same scale

***Apis* (*Micrapis*) *andreniformis* Smith.** The Black Dwarf Honey Bee is the native and most common species of *Micrapis* in Indonesia, ranging throughout the western half of the country [Greater Sunda Islands (Sundaland)] (Otis 1996), although putatively only marginally extending past the Makassar Strait in Sumbawa and westernmost Flores (Hepburn & Radloff 2011). The species is often found in forests but is in fact widespread and found in plains as well, but typically not in human settlements. Like *A. florea*, nests are constructed in dense thickets and often shaded.

***Apis* (*Micrapis*) *florea* Fabricius (Not native, introduced).** The Red Dwarf Honey Bee is native to the mainland of Asia, where it is widespread, extending from the Sudan in Africa all the way to Vietnam and southeastern China, although natively its western extremes were the Iranian Plateau and easternmost areas of Arabia. It was historically introduced to Java and therefore may be found within Indonesia. Natively, the closest it comes is around the Thai-Malaysian border on the Malay Peninsula. As with *A. andreniformis*, nests are often shaded and built in thickets, although it is not uncommon to find them building nests in human settlements and from manmade structures. In the wild the species tends to be found more often in savannah woodlands, forests, or disturbed areas. As natural habitats are disturbed, *A. florea* tends to do fine, while *A. andreniformis* would be more susceptible to population declines owing to habitat destruction (much in the same way that *A. koschevnikovi* is more susceptible than is *A. cerana*).

***Apis* (*Megapis*) *dorsata* Fabricius.** The Giant Honey Bee is widespread and common across Indonesia. Nests, like those of the dwarf honey bees, are exposed. The nests of *A. dorsata* are typically constructed in open, conspicuous areas, such as tall trees, rock faces, or buildings, and are often aggregated and at heights above 6 m, although they can be found below this level frequently. Workers of *A. dorsata* can be quite aggressive when colonies are disturbed and their sting is perhaps the most painful of any species of *Apis*. Various authors have argued to split *A. dorsata* into multiple species, the most prominent of which is *A. d. laboriosa* Smith (*e.g.*, Sakagami *et al.* 1980, Radloff *et al.* 2011), but also the forms *A. d. breviligula* (Maa) in the Philippines (Maa 1953, Lo *et al.* 2010) and *A. d. binghami* Cockerell in Sulawesi and the Sula Islands (Maa 1953). None of these have rigorous support as distinct species (Engel 1999).

***Apis* (*Apis*) *cerana* Fabricius.** This is, of course, the common Eastern Honey Bee, which is widespread over most of Asia. *Apis cerana*, like *A. mellifera*, is a robust species which does well in managed and disturbed

systems, in stark contrast to some of its close relatives (*e.g*., *A*. *koschevnikovi*) which are more susceptible to habitat degradation. It is also a species with considerable variation, some of which has at times been split off as separate species (*e.g*., Maa 1953). Most notably the subspecies, *A*. *cerana nuluensis* Tingek *et al*. is merely an autapomorphic type of *A*. *cerana* (Engel 1999), showing all of the usual features of a high elevation form for bees (much in the same manner as distinctive mountain populations of *A*. *mellifera* in Africa). This form is found in the mountains of Sabah, although it is possible it extends along the entire Crocker Range and from there deeper into Borneo, perhaps including Kalimantan.

***Apis* (*Apis*) *koschevnikovi* Enderlein.** *Apis koschevnikovi* is found on the Malay Peninsula, and throughout Borneo, Sumatra, and Java, although in many places where the species was once recorded populations have not been seen recently suggesting that the bees may be in decline or at least susceptible to human-induced habitat disruption (Otis 1996, Hepburn & Radloff 2011). The species tends to prefer tropical evergreen forests. Given the observed declines in populations this species should be studied carefully and efforts made to preserve the habitats in which it occurs.

***Apis* (*Apis*) *nigrocincta* Smith.** *Apis nigrocincta* occurs on Sulawesi and Mindanao in the Philippines. Little is known of its biology except that, where documented, it is similar to that of *A*. *koschevnikovi*. Perhaps one of the most distinctive features of the species is not to be found in the bees themselves, but instead their nests which lack the well-known pore in the drone cell cappings, a feature otherwise present in *A*. *cerana* (Hadisoesilo & Otis 1998). This is a little-studied honey bee richly deserving of intensified research.

***Apis* (*Apis*) *mellifera* Linnaeus (Not native; introduced).** The Western Honey Bee, *A*. *mellifera*, has been artificially transported by man for thousands of years. Its introduction and management in the islands of Southeast Asia has been largely a phenomenon of more recent efforts, and mostly by larger commercial interests over those of indigenous and local peoples. I strongly advocate the position taken by Koeniger *et al*. (2010) in advocating for the preservation and development of Asian honeys by native Asian honey bee species over the introduction of this European species, and one which has a detrimental effect on the surrounding environments.

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