

## Notes on *Vespa analis* and *Vespa mandarinia* (Hymenoptera, Vespidae) in Hong Kong, and a key to all *Vespa* species known from the SAR

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### ABSTRACT

A brief summary of two uncommon hornet species in Hong Kong, *Vespa analis* and *Vespa mandarinia*, is provided, with notes on their biology in other regions. A key to all species of *Vespa* occurring in Hong Kong is also given.

**Key words:** Hymenoptera, Vespidae, Vespinae, *Vespa*, *analis*, *mandarinia*, hornet, wasp

### INTRODUCTION

*Vespa analis* Fabricius, 1775 and *Vespa mandarinia* Smith, 1852 are hornet species with fairly wide distributions throughout East Asia. Both species are present in Hong Kong, which lies within their distributional range, although they are uncommon and rarely seen. This paper presents some background information regarding both species, with notes on their distribution and previous records within Hong Kong, as well as on their biology from what is known about them in other parts of their range.

### IDENTIFICATION

Eight species of *Vespa* (hornets) are present in Hong Kong, of which six are common and regularly seen. The two uncommon species covered in this paper can easily be identified by the following characteristics: they are medium-sized to very large species with the last abdominal segment completely orange-yellow. The last abdominal segment of all other local species is always either completely dark or partly reddish, except for *Vespa bicolor* Fabricius, 1787, which however is a small and very distinct species that cannot be mistaken for anything else. A key to the eight known *Vespa* species in Hong Kong is given here. This key is based on both structural and colour characteristics, and is intended mainly for use within Hong Kong, as individuals of some species exhibit considerable differences in colour in other regions. Measurements are taken from specimens in my personal collection.

1.
  - a. Ground colour, including entire abdomen, light yellow. Small species (queens 25mm, workers generally under 20mm) - ***Vespa bicolor*** Fabricius, 1787.
  - b. Ground colour not entirely yellow. - **2**
- 2(1).
  - a. Head entirely yellow or orange. - **3**
  - b. Head either completely or partly (vertex, frons, part of gena) dark brown or black. - **4**
- 3(2).
  - a. Head strongly widened, with gena enlarged behind the eyes and at least 1.8x as wide as the eye in the female or 1.3x in the male from a lateral view. - **5**
  - b. Head not strongly widened, with gena being equal to or narrower than the eye when viewed laterally. - **6**
- 4(2).
  - a. Frons, vertex black. Clypeus, mandibles and lower part of gena predominantly orange. Thorax fully black. Ground colour of abdomen black with metallic gold sheen. Last abdominal segment partly reddish. Small to medium-sized (queens to 28mm, workers generally under 24mm) - ***Vespa velutina*** Lepeletier, 1836.
  - b. Head reddish brown. Abdomen black apart from a distinct yellow band. - **7**
- 5(3).
  - a. Sixth abdominal segment entirely yellow. Abdomen with orange or yellow bands which may vary greatly in width between individuals and populations. Very large species (queens may reach or exceed 45mm, workers between 25mm and 40mm). - ***Vespa mandarinia*** Smith, 1852.
  - b. Sixth abdominal segment black. Abdomen largely black, apart from first two segments coloured with bands of orange, yellow and black. Very large species (queens to 46mm, workers between 23mm and 39mm). - ***Vespa soror*** du Buysson, 1905.
- 6(3).
  - a. Sixth abdominal segment entirely yellow. Abdomen dark brown with yellow or orange bands which may vary greatly in width. A rather blunt, triangular tooth present on the anterior margin of the clypeus. Generally medium-sized species (22mm to 30mm), although some individuals may attain larger sizes. - ***Vespa analis*** Fabricius, 1775
  - b. Sixth abdominal segment black. Abdomen largely black, apart from first two segments coloured with bands of orange-brown, yellow and black, and sometimes a thin yellow band at the posterior margin of the second tergite. Large species (22mm to 35mm) - ***Vespa ducalis*** Smith, 1852.
- 7(4).
  - a. Yellow band on abdomen comprising of only second tergite largely yellow. Larger species (20mm to 34mm). - ***Vespa tropica*** (Linnaeus, 1758).

- b. Yellow band on abdomen comprising of both first and second terga largely yellow. Smaller species . - *Vespa affinis* (Linnaeus, 1764), (workers generally under 24mm, queens up to 30mm).

*Vespa analis* and *V. mandarinia* are fairly similar in appearance, and a large individual of *V. analis* or a small individual of *V. mandarinia* might be confused with the other species at a glance while flying past, but both are easily separable by structural attributes, the most obvious of which would be the strongly enlarged head of *V. mandarinia*, with the gena proportionately wider in comparison to the eye in side profile (at least 1.8x in the female). *V. analis*, on the other hand, is the only *Vespa* species known to have a median tooth on the anterior margin of the clypeus.

#### NOTES ON *VESPA ANALIS*

*Vespa analis* is widely distributed throughout East and Southeast Asia, with the southernmost limit of its range being Indonesia and extending all the way to Eastern Russia and India (Archer 1998; Carpenter and Kojima 1997). In Hong Kong, there appear to be two distinct colour forms (pers. obs.). The more commonly seen form is reddish brown with a yellow head. The pronotum is often reddish, but sometimes the same ground colour as the rest of the thorax. The abdomen is brown with a strong red tinge, the apical margin of each segment having an orange-yellow band which may vary considerably in width between individuals. This form can somewhat resemble the common Chinese-Japanese colour form of *V. mandarinia* in appearance. In the other colour form, which appears to be exceedingly rare, the ground colour is an even darker brown with hardly any reddish tinge, and with the yellow bands being merely thin lines. This species is extremely variable in size, with most individuals in Hong Kong being approximately 22mm to 30mm (pers. obs.). Some individuals may be much larger, although this is more common with individuals from Southeast Asian regions such as Singapore (pers. obs.). There is not much difference in size between queens and late workers in mature colonies.

*Vespa analis* appears uncommon in Hong Kong, although it does not appear to have a very limited local distribution. I have seen it mainly in the New Territories, namely in many parts of Sai Kung, Ma On Shan, Tai Po, Fanling, Sheung Shui, Yuen Long and Tuen Mun. I have also seen individuals in Aberdeen Country Park, Victoria Peak and Lamma Island. A majority (70%;  $n = ?$ ) of these records were of the more common colour form, with the darker colour form, which is identical to that formerly described as subspecies "*Vespa analis nigrans*" found in various parts of continental Asia including Peninsular Malaysia and Vietnam (Martin 1995; Nguyen et al 2006; Vecht 1957), being very rare and limited to Sai Kung and the Northern New Territories.

I have yet to personally see a nest of *V. analis* in Hong Kong.

However, I have seen photos by local photographers of abandoned nests located among dense clusters of small trees in country parks or, in one case, a cave, which appear to be of this species. *V. analis* nests somewhat resemble nests of *Vespa affinis* (Linnaeus, 1764) but do not generally reach such large sizes. In addition, the markings on the envelope are quite distinctive, the circular patterns being generally very large and highly contrasting in colour. The envelope is typical of an aerial-nesting hornet, being complete and covering the nest completely except for a single entrance situated laterally on one side of the envelope. Nests and colonies in subtropical Hong Kong would probably be smaller than their counterparts in tropical equatorial regions but larger than those in temperate regions; they could possibly reach a maximum of 40cm in vertical length and 30cm wide, and colonies would probably comprise of up to 200 wasps or fewer at their peak. Although the exact colony cycle in Hong Kong is unknown, it can be expected to be fairly long, as new queens often appear during March or April, and I have seen workers attempting to catch prey such as butterflies as late as early January.

In March to April, new queens can generally be seen feeding on nectar from flowers of *Litchi chinensis* (lychee) and *Dimocarpus longan* (longan). In summer, workers feed on flowers and rotting fruit of *Musa sp.* (banana). Towards September to January, the workers and possibly males and new queens frequent various species of *Camellia*. In terms of prey choice, this species is a generalist predator, which will capture any smaller insects, especially flying ones near flowers. I have observed it catching honeybees and butterflies in Hong Kong, and have witnessed individuals in Singapore capture dragonflies as well.

*Vespa analis* is, as mentioned above, by no means restricted in its distribution in Hong Kong, although it appears to be more abundant in country parks and rural areas. However, a small number of sightings have been made in urban parks, mainly in Fanling, Sheung Shui and Yuen Long. It appears to be more common at higher altitudes, with most sightings so far having been made at elevations between 100m and 700m. There appears to be a small but thriving population of this species locally, and it might not actually be as rare as it appears to be. One reason for its apparent rarity and difficulty in finding nests is its exceedingly shy nature, which is apparent in its flight pattern (pers. obs.). Workers of this species generally fly close to dense vegetation, often cutting in and out, therefore trying to follow a foraging worker can be extremely difficult. In fact, a large insect with the abdomen sporting a yellow tip disappearing into the foliage of a tree or bush is often all that is seen of this species. Even at flowers of fruit trees or *Camellia* trees, it will fly back into the canopy to access flowers at another side of the tree, rather than flying around on the outside. This species is also alert and difficult to approach - it will flee at the slightest disturbance. The only time it is more approachable is when feeding on banana flowers or rotting fruits in summer.

In Singapore, *V. analis* is extremely abundant and will even

nest in urban areas (pers. obs.). However, the nests are not always easy to find. I have, on several occasions, followed a distinct flight path leading into a tree or cluster of shrubs, thinking the nest would definitely be within, only to find out that the said tree or bushes turned out to be merely a 'transit point' - the wasps would then fly out from the foliage at an angle to their original flight path, in another direction. The actual nest was often located in another tree, not necessarily within view of the transit point, and in fact one colony I observed used two such transit points before returning to the nest, which was about 60m and 20m away from the first and second clusters of shrubs respectively. This strange behaviour seems to function well in helping nests escape detection from natural predators. Indeed, even in urban areas with high human traffic many nests go unnoticed and complete their colony cycle without being discovered due to the species' secretive nature. The flight manner of *V. analis* in Hong Kong appears identical to their counterparts in Singapore (pers. obs.). Due to the fact that *V. analis* is much rarer locally as compared to in Singapore and is more confined to rural areas and country parks, nests in Hong Kong would prove very difficult to locate.

In contrast to its shy, secretive habits, *V. analis* is highly aggressive and territorial around sources of food such as flowers and fruit. Individuals often attack and chase other hornets, preventing them from landing and feeding. Even smaller-sized individuals often dominate larger individuals of *V. ducalis* and *V. tropica*. It is probable that only *V. soror* and *V. mandarinia* are more aggressive and dominate *V. analis* at such sources of food. In addition, *V. analis* is also said to be the species most likely to successfully repel or kill *V. mandarinia* in defense of their nest in Japan (Matsuura and Sakagami 1973). However, *V. analis* is known to be a fairly placid and unaggressive species in regards to colony defence (Matsuura 1973a; Vecht 1957; Starr 1992; personal observations). Workers generally pay no attention to people moving near the nest, and only attack if the nest is actually disturbed. The number of attacking workers is usually fairly small and the distance over which the attacking wasps give chase usually not very far. Still, it is wise to avoid disturbing nests of any social wasp.

#### NOTES ON *VESPA MANDARINIA*

*Vespa mandarinia* is also widely distributed throughout East Asia and shares much of its range with *Vespa analis*. Indeed, the Chinese name for *V. analis* translates roughly to "mimic of *V. mandarinia*" (Li 1985; Yamane and Wang 1996). This is largely due to the fact that *V. analis* in any given region often somewhat resembles the colour form of *V. mandarinia* in the same locality.

*Vespa mandarinia* is fairly well-studied in Japan (Archer 1995; Matsuura and Sakagami 1973; Yamane and Makino 1977) and is one of the best-known hornets due to it being the largest known hornet species and the harm it poses to beekeepers. Although single individuals will hunt any smaller insect they can overpower, the species is best known for its ability to launch

coordinated attacks on nests of honeybees and other social wasps. This usually takes place late in the season, prior to the emergence of reproductives (males and new queens), and can probably be attributed to a greatly increased need for nutrition for the large number of larvae which will become reproductives, the only ones intended to survive and carry on the next generation. The attacking process can be divided into three stages, namely the hunting phase, slaughter phase and occupation phase (Matsuura and Sakagami 1973). *V. mandarinia* was previously thought to be the only species to do this, but in Hong Kong the closely related *V. soror* commonly does this too and is a considerable menace to the beekeeping industry locally (Lee, 2009).

The colony cycle of *V. mandarinia* in Hong Kong is not known, but can be assumed to be fairly long, since its colony cycle in temperate Japan is known to be quite long as well (Archer 1995). Colony cycles of most *Vespa* species are longer in the tropics than in the subtropics, and in turn longer in subtropical regions compared to temperate regions. The species usually nests underground and sometimes in tree hollows or very rarely, within buildings in rural areas (Matsuura and Koike 2002). The nest is fairly large, usually comprising four to seven combs, although larger nests with more combs have been reported in Taiwan (Yamane and Wang 1996), so it is definitely possible that nests and colonies in subtropical Hong Kong can reach larger sizes than in temperate regions. The envelope is incomplete, covering the sides of the nest but leaving the bottom exposed - this is typical of many ground-dwelling hornets (Matsuura 1973b). The cavity is enlarged by the wasps as the nest grows, and the workers spend a lot of time excavating earth, compacting it into small pellets and depositing these pellets outside the nest entrance, rather than flying off and dropping them some distance from the nest, as some other *Vespa* species do (Matsuura 1991; Matsuura and Sakagami 1973). *V. mandarinia* was once thought to be the only hornet to exhibit this excavation behaviour (Matsuura 1991), although the closely related *V. soror* also does so, and *V. tropica* as well (pers. obs.). The presence of excavated soil pellets is often how nests are discovered (Matsuura and Sakagami 1973). The workers are aggressively territorial, and will fly out to investigate and warn off any moving object near the nest, therefore it is strongly recommended that one maintain a safe distance of more than three metres should a nest be encountered. All these aspects of its biology also apply to *V. soror*; the two species are clearly extremely similar in biology.

*Vespa mandarinia* has previously been recorded from Hong Kong (Carpenter and Kojima 1997; Vecht 1959), and a series collected from various localities in China in the Muséum National d'Histoire Naturelle (National Museum of Natural History, Paris) collection apparently includes specimens from Hong Kong (Vecht 1959). As quoted directly from Vecht: "A series from various localities (Se-Tchouen, Ta-Tsien-Lou, Siao-Lou, Hongkong, Kiangsi, Shanghai and Kouy-Tcheou, region de PinFa) (MP)". Vecht also noted that the Chinese specimens were somewhat variable in colour, but generally had the dark bands on the abdomen thinner

than specimens from Japan, and with the pronotum more constantly ferruginous. So far, the individuals observed by the author in Hong Kong generally agree with this statement in having the dark bands thinner than specimens from Japan (i.e., the yellow bands consequently wider in proportion to the black bands), although I have not had access to a large enough sample of specimens to confirm this definitively.

*Vespa mandarinia* appears extremely rare in Hong Kong. Its distribution in Hong Kong appears generally confined to the outlying islands, although some beekeepers in Fanling and Yuen Long have related incidents of this species attacking their hives to the author; however, they noted that these incidents took place many years back and that *V. mandarinia* have not been seen in their apiaries for a long time. I have only three confirmed personal records of this species locally. The first of these was an enormous individual, probably a new queen, feeding on banana flowers in Pui O, Lantau Island, on May 1996. No collecting equipment or holding containers were at hand and thus the individual was not collected. The second was found dead on Lamma Island in April 2008 by the author along with Christophe Barthelemy and Chan Kam Wah. It was a rather small individual, possibly one of the earliest workers to emerge. The third confirmed sighting occurred on Lantau Island near Ngong Ping, where an individual clearly belonging to this species was observed in flight. Several other sightings which could apparently be of this species but could not be confirmed positively have been made by the author and Chan Kam Wah on Lantau Island, Lamma Island and Tung Ping Chau. Paul Aston also related cases of large hornets attacking nests of *Polistes olivaceus* and *Parapolybia varia* in Mui Wo, Lantau. He noted two of the largest species, one of which could be clearly identified as *V. soror*, while the other, which he described as even larger and stockier with distinct banding, clearly fitted the description of *V. mandarinia*. Besides the Chinese-Japanese colour form, a beekeeper in Fanling related an incident in which a single large hornet captured bees from a hive entrance; his description fitted the "Western colour form" (which is often referred to as *V. magnifica* or *V. mandarinia magnifica* in older publications) of the species; this form can be found in Western China as well as Northern Thailand and North Vietnam. While it is not impossible that two colour forms would co-exist locally, as is seen with *V. analis*, I have not seen the wasp in question and cannot rule out the possibility of it being a large individual of the darker colour form of *V. analis*, which closely resembles the Western colour form of *V. mandarinia*. Therefore the presence of this second colour form in Hong Kong cannot be confirmed at this point.

#### CONCLUSION

From my limited personal observations, although large individuals of *V. analis* may be mistaken for small individuals of *V. mandarinia*, the flight pattern of the two species differs considerably, with the latter often flying boldly and in the open. On the one occasion I approached an individual at banana flowers, it circled boldly upon being disturbed and did not flee quickly as *V. analis* usually does. Furthermore, even small

individuals of *V. mandarinia* are proportionately more robust and stocky in shape and this is another factor which may help in distinguishing the two species. In short, both species can be distinguished fairly accurately from each other even at a distance.

The apparent rarity of *V. mandarinia* in Hong Kong is somewhat unexpected, considering that this species has fairly large colonies, a long colony cycle and the fact that workers covers substantial distances in their search for the great amount of food needed to sustain the colony. One would naturally assume that the individual wasps, at least, would be more visible. However, this is apparently not uncommon over parts of its range. *V. mandarinia* and *V. soror* do not have much geographical overlap, but in many places where they do, *V. soror* is often the more common species with *V. mandarinia* being very scarce and limited in distribution. This is so in Vietnam (Nguyen and Carpenter 2002; Nguyen et al 2006) and also in China's Guangdong Province (personal communication with several professional hornet hunters who capture entire nests for the brood which are often eaten in rural parts of China). Clearly, more research into *V. mandarinia* in Hong Kong will be required to learn more about its biology locally.

#### ACKNOWLEDGEMENTS

I would like to thank Christophe Barthélemy for reviewing this article and offering advice on how to improve it, as well as sharing observations and experiences. Finally I also thank Chan Kam Wah and Paul Aston for sharing invaluable observations.

#### REFERENCES

- Archer, M.E. 1995. Taxonomy, distribution and bionomics of the *Vespa mandarinia* group (Hymenoptera, Vespinae). *Entomologist's Monthly Magazine* 131: 47-53.
- Archer, M.E. 1998. Taxonomy, distribution and nesting biology of *Vespa analis* F. (Hym., Vespidae). *Entomologist's Monthly Magazine* 134: 215-222.
- Barthelemy, C. 2008. A provisional identification guide to the social Vespids of Hong Kong (Hymenoptera: Vespidae). (Downloadable at [http://www.insectahk.com/book\\_page.html](http://www.insectahk.com/book_page.html)).
- Carpenter, J.M. and Kojima, J. 1997. Checklist of the species in the subfamily Vespinae (Insecta: Hymenoptera: Vespidae). *Natural History Bulletin*, Ibaraki University, 1: 51-92.
- Lee, J.X.Q. 2009. *Potentially dangerous bees and wasps of Hong Kong*. Hong Kong Entomological Society Popular Entomology Book Series #2.
- Li, T.S. 1985. *Economic Insect Fauna of China*, Fasc 30 - Hymenoptera, Vespoidea. Science Press, Beijing, China. [In Chinese].
- Matsuura, M. 1973a. Nesting habits of several species of the genus *Vespa* in Formosa. *Kontyû* 41 (3): 286-293.

Matsuura, M. 1973b. Nesting sites of the Japanese *Vespa* species. *Kontyû* 39 (1): 43-54.

Matsuura, M. 1991. *Vespa* and *Provespa*. In: *The Social Biology of Wasps*, (Ross, K.G. and Matthews, R.W. eds.). Cornell University Press.

Matsuura, M. and Koike, K. 2002. Studies on the ecology of social wasps and bees in urban environments 1. Records on aerial nests of the giant hornet, *Vespa mandarinia japonica* (Hymenoptera: Vespidae) within human buildings. *Med. Entomol. Zool.* 53(3): 183-186.

Matsuura, M. and Sakagami, S. 1973. A bionomic sketch of the giant hornet, *Vespa mandarinia*, a serious pest for Japanese apiculture. *Journal of the Faculty of Science, Hokkaido University Series VI. Zoology*, 19(1): 12-162.

Martin, S.J. 1995. Hornets (Hymenoptera: Vespinae) of Malaysia. *Malayan Nature Journal* 49: 71-82.

Nguyen, T.P.L. and Carpenter, J.M. 2002. Vespidae of Vietnam (Insecta: Hymenoptera) 1. Vespinae. *Journal of the New York Entomological Society* 110(2): 199-211.

Nguyen, T.P.L., Saito, F., Kojima, J. and Carpenter, J.M. 2006. Vespidae of Viet Nam (Insecta: Hymenoptera) 2. Taxonomic notes on Vespinae. *Zoological Science* 23: 95-104.

Starr, C.K. 1992. The social wasps (Hymenoptera: Vespidae) of Taiwan. *Bulletin of the National Museum of Natural Science, Taichung* 3: 93-138.

Vecht, J. van der 1957. The Vespinae of the Indo-Malayan and Papuan areas (Hymenoptera, Vespidae). *Zool. Verh. (Leiden)* 34: 1-83.

Vecht, J. van der 1959. Notes on Oriental Vespinae, including some species from China and Japan (Hymenoptera, Vespidae). *Zool. Meded.* 36: 205-232.

Yamane, Sk. and Makino, S. 1997. Bionomics of *Vespa analis insularis* and *V. mandarinia latilineata* in Hokkaido, Northern Japan, with notes on Vespine embryo nests (Hymenoptera: Vespidae). *Insecta Matsumurana*, New Series 12.

Yamane, Sk. and Wang, H.Y. 1996. *Guide Book to Insects in Taiwan (16) - Hornets, Paper Wasps and Potter Wasps*. Shu Shin Publications, Taiwan.

Figure 1. A worker of *V. analis* on flower of *Musa* sp. (banana)



Figure 2. Another worker of *V. analis*



Figure 3. An individual of the dark colour form of *V. analis*



Figure 4. Frontal closeup of *V. analis*, showing the distinctive feature on the clypeus



Figure 5. Typical nest of *V. analis* in Singapore



Figure 6. Habitus of a worker *V. mandarina*  
Fig. 6a Lateral view



Fig. 6b Dorsal view



Fig. 6c Frontal view

