Ants of the Genus *Myrmica* from Taiwan (Hymenoptera: Formicidae)

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**ABSTRACT**

Four species of the temperate ant genus *Myrmica* are found on Taiwan, all except *M. serica* are known only from the island. Three are previously described species (*M. formosae*, *M. serica* and *M. arisana*) and the fourth is an hitherto unknown species (*M. mirabile*). The status of all four species is reviewed and a key to their identification is provided. *M. mirabile* has exceptionally large workers for a *Myrmica* ant, and differs in this respect from all other known species except *M. gigantea* (Collingwood).

**Key Words:** Taiwan, Asia, taxonomy, new-species, *Myrmica mirabile*.

**Introduction**

The island of Taiwan has a predominantly tropical and subtropical myrmecofauna. However, some temperate genera are found in Taiwan, usually at high altitudes in the mountains. Included among these is the genus *Myrmica* Latreille from which several species and infra specific forms have been described (Wheeler, 1929, 1930; Santschi, 1937). These are particularly interesting because they are well isolated from the nearest other Chinese populations of *Myrmica* ants and may be representative of an older relict fauna.

Four *Myrmica* species have been recorded from Taiwan. Three are possibly endemic: one of these is previously undescribed (*Myrmica mirabilis* sp. n.) and is morphologically unusual for the genus; another (*Myrmica arisana* Wheeler) belongs to the ruginodis-silvestrii complex of *Myrmica* species, which are abundant in the temperate forests of east Asia. The third endemic (*Myrmica formosae* Wheeler) belongs to the ritae-group of *Myrmica* species (Radchenko and Elmes, 1998) which is considered to be the most primitive of the groups of *Myrmica* (Radchenko, 1994). The fourth species (*Myrmica serica* Wheeler) also belongs to the ritae-group, and has been found in southern China besides Taiwan. Here we review the known species, describe the new and exceptional species, and provide a key for the identification of the four Taiwanese *Myrmica*.

**Materials and Methods**

This paper is based on the study of material from the Museum of Comparative Zoology, Harvard University, USA.
(MCZ), Naturhistorisches Museum, Basle (BASLE) and Keiichi Onoyama, Obihiro University of Agriculture, Inda-cho, Japan (OUJ). Other abbreviations used are - BMNH (British Museum of Natural History), ZMM (Zoolological Museum of Moscow State University) and IZK (Institute of Zoology, Kiev).

In studies of Myrmica it has become customary to make a series of body measurements and to calculate various shape indices (Arnoldi, 1934; Sadil, 1951; Seifert, 1968) and in order to facilitate comparisons between the Taiwanese Myrmica and other species, we have made the following measurements and indices.

**HW** maximum width of head in full-face view above eyes.

**HL** length of head in full-face view, measured in a straight line from anterior point of median clypeal margin to mid-point of occipital margin.

**FW** minimum width of frons between frontal lobes.

**FLW** maximum width between external borders of frontal lobes.

**SL** maximum straight-line length of antennal scape in profile.

**PNW** maximum width of pronotum from above.

**AL** diagonal length of alitrunk, measured in profile from neck shield to posterior margin of metapleural lobes.

**PL** maximum length of petiole from above.

**PPL** maximum length of postpetiole from above.

**PW** maximum width of petiole from above.

**PPW** maximum width of postpetiole from above.

**PH** maximum height of petiole in profile.

**PPH** maximum height of postpetiole in profile.

**ESL** maximum length of propodeal spine in profile.

**ESD** distance between tips of propodeal spine from above.

**HTL** length of hind tibia.

**Cephalic index** CI = HL / HW

**Frontal index** FI = FW / HW

**Frontal-lobe index** FLI = FLW / FW

**Scape index** (1) SI1 = SL / HL

**Scape index** (2) SI2 = SL / HW

**Petiole index** (1) PI1 = PL / PH

**Petiole index** (2) PI2 = PL / HW

**Post-petiole index** (1) PPI1 = PPL / PPH

**Post-petiole index** (2) PPI2 = PPH / PPW

**Post-petiole index** (3) PPI3 = PPW / PW

**Spine-length index** ESL1 = ESL / HW

**Spine-width index** ESD1 = ESD / ESL

**Hind-tibia index** HTI = HTL / HW

Key to the Myrmica species of Taiwan

1. Head and alitrunk very coarsely rugose; petiole and propodeal spines very long (Figs. 6-8)

   - Head and alitrunk much more finely rugulose or reticulate; petiole and propodeal spines distinctly shorter (Figs. 1, 2, 9, 10)

2. Frons between frontal carinae level with the eyes (central frons) with 4 extremely coarse rugae (Fig. 7)

   - Central frons with at least 6 finer rugae (Fig. 8)

3. Very large ants (HW>1.65 mm, AL>2.50 mm); antennal scape strongly curved at base but without an angle; whole body with very abundant pilosity (Figs. 1-5)

   - Size much smaller (HW<1.20 mm, AL<2.10 mm); antennal scape weakly curved at base; pilosity on body much less abundant (Figs. 9-11)

The species

1. Myrmica mirabile sp. n. (Figs. 1-5)

   Materials examined: Holotype worker, ALISHAN (=Arisanca), 21.X.1777, K. Yamauchi (BMNH). Paratypes: 10 workers from the same nest (BMNH, IZK, OUJ).
Figs. 1-11 *Myrmica mirabile* sp. n. holotype worker (1-5), *Myrmica formosae* lectotype worker (6,7), *Myrmica serica* holotype worker (8), *Myrmica arisana* lectotype worker (9-11): 1, 6, 9 alitrunk, petiole and postpetiole in profile; 2, 7, 8, 10 head, frontal view; 3 propodeal spine, petiole and postpetiole from above; 4, 11 antennal scape; 5 hind tibia.
Workers: Head slightly longer than wide (CI 1.07-1.12) with somewhat convex sides; occipital margin straight or very slightly concave, rounded occipital corners. Anterior clypeal margin slightly convex with no medial notch; frontal carinae slightly curved, curving outwards and merging with rugae surrounding antennal sockets. Frons relatively wide (FI 0.34-0.39); eyes convex, oval, located slightly anteriorly to mid point of sides of head. Antennal scapes distinctly shorter than the head (SLI 0.82-0.88), strongly curved at base but not angled, no trace of a lobe; funicular joints relatively short (<1.5 longer than wide) with 4-jointed apical club. Promesonotum convex and propodeal dorsum more or less flat; promesonotal suture distinct and meso-propodeal furrow distinct but shallow; metapleural lobes rounded. Propodeal spines moderately long (ESLI 0.29-0.37), wide at base, projecting posteriorly upwards with slight downwards curve, and appearing slightly divergent from above (ESDII 1.03-1.22). Petiole with short anterior peduncle and relatively high (PPII 1.24-1.50). In profile petiole anterior surface slightly concave, posterior surface flat or somewhat convex, node appearing subtriangular and narrowly rounded on top. Postpetiole subcubical, with feebly arched dorsum (PPII 0.84-0.93). Both petiole and postpetiole without ventral lobes.

Middle and hind tibiae have well developed pectinate spurs. Head dorsum densely but not coarsely, longitudinally rugulose, with reticulate sculpture on posterior and lateral parts; surfaces between rugae finely punctured but appear more or less shiny. Clypeus has numerous longitudinal fine rugae; frontal area very finely superficially sculptured, but appears shiny; mandibles finely but densely longitudinally rugulose. Alitrunk sinuously rugulose with only lower parts of meso- and metapleurae being longitudinally rugose, surface between sculpture smooth and shiny. Propodeal declivity between propodeal spines smooth and shiny. Both petiole and postpetiole with short sinuous rugosity, fine punctures between rugae, appearing submatt. Gaster has short striae at base of first tergite but otherwise, has only very fine superficial reticulation appearing smooth and shiny. Head, alitrunk, waist and gaster with very abundant curved fine hairs; legs and antennal scape have suberect hairs. Overall colour yellowish-red but appendages slightly lighter.

Notes: Measurements and indices are given in Tables 1 & 2. M. mirabile is unusually large (HW 1.62-1.83 mm) and currently is the Myrmica species having the largest workers known for the genus worldwide, exceeding by about 5% the previous largest - Myrmica gigantea (Collingwood) (ritae-group, HW 1.62 mm). Morphologically it appears to be closely related to Myrmica luteola Kupyanovskaya 1990, but otherwise it is clearly different from all other Myrmica ants. Apart from its size, M. mirabile mainly differs from M. luteola by the absence of the pre-socially-parasitic characters associated with the latter. For example, M. luteola has lobe-like processes on ventral surfaces of the petiole and postpetiole, reduced, simple, non-pectinate spurs on the middle and hind tibiae, which are small, and sometimes hardly distinguishing from apical setae. The females and males of M. luteola are very small, sometimes smaller than the workers, and females have very short, dentiform propodeal spine or even tubercles. Unfortunately males and females of M. mirabile are unknown, but we suggest that they will be found to be "normal" for Myrmica. It is possible that M. luteola is a "microgyne" derivation of M. mirabile which is in the process of evolving towards a socially-parasitic lifestyle. Little is known about the ecology of M. mirabile other than its nest was found in decaying wood on a forest margin. A comparative ecological study
Table 1. The measurements made on the type specimens and the minimum and maximum values (mm) of the measurements made on samples of specimens (number in parenthesis) from the Taiwanese *Myrmica* (The measurements codes are as indicated in the text)

<table>
<thead>
<tr>
<th></th>
<th><em>M. mirabile</em> (11)</th>
<th></th>
<th><em>M. arisana</em> (5)</th>
<th></th>
<th><em>M. formosae</em> (8)</th>
<th></th>
<th><em>M. serica</em> (9)</th>
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</thead>
<tbody>
<tr>
<td>Holotype</td>
<td>Min-Max</td>
<td>Lectotype</td>
<td>Min-Max</td>
<td>Lectotype</td>
<td>Min-Max</td>
<td>Lectotype</td>
<td>Min-Max</td>
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<tr>
<td>HW</td>
<td>1.68</td>
<td>1.62-1.83</td>
<td>1.18</td>
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<td>1.11-1.26</td>
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<td>1.36</td>
<td>1.32-1.42</td>
<td>1.40</td>
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<tr>
<td>PW</td>
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<td>0.60-0.70</td>
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<td>0.50-0.66</td>
<td>0.47</td>
<td>0.43-0.49</td>
<td>0.47</td>
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<td>PLW</td>
<td>0.71</td>
<td>0.69-0.78</td>
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<td>0.57-0.60</td>
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<td>SL</td>
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<td>1.30</td>
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<td>PNW</td>
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<td>0.82-0.88</td>
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<td>0.41</td>
<td>0.40-0.45</td>
<td>0.36</td>
<td>0.34-0.37</td>
<td>0.34</td>
<td>0.31-0.36</td>
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<tr>
<td>PPW</td>
<td>0.57</td>
<td>0.52-0.63</td>
<td>0.54</td>
<td>0.50-0.54</td>
<td>0.53</td>
<td>0.49-0.55</td>
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<tr>
<td>PH</td>
<td>0.56</td>
<td>0.52-0.63</td>
<td>0.42</td>
<td>0.42-0.48</td>
<td>0.38</td>
<td>0.35-0.40</td>
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<td>PPH</td>
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<td>0.56-0.64</td>
<td>0.55</td>
<td>0.52-0.58</td>
<td>0.51</td>
<td>0.48-0.53</td>
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<tr>
<td>PL</td>
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<td>0.74-0.88</td>
<td>0.60</td>
<td>0.48-0.60</td>
<td>0.82</td>
<td>0.74-0.83</td>
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<td>PPL</td>
<td>0.53</td>
<td>0.50-0.60</td>
<td>0.40</td>
<td>0.35-0.42</td>
<td>0.56</td>
<td>0.55-0.61</td>
<td>0.58</td>
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<tr>
<td>ESL</td>
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<td>0.50-0.64</td>
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<td>0.72</td>
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<td>ESD</td>
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<td>0.56-0.70</td>
<td>0.51</td>
<td>0.47-0.57</td>
<td>0.61</td>
<td>0.52-0.68</td>
<td>0.54</td>
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<td>AL</td>
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<td>2.56-2.92</td>
<td>2.02</td>
<td>1.86-2.02</td>
<td>2.18</td>
<td>1.97-2.32</td>
<td>2.06</td>
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<tr>
<td>HTL</td>
<td>1.61</td>
<td>1.52-1.70</td>
<td>1.14</td>
<td>1.02-1.14</td>
<td>1.44</td>
<td>1.34-1.51</td>
<td>1.38</td>
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</table>

Table 2. The index values for the type specimens and the range made from measuring a sample of other specimens (number in parenthesis) from the Taiwanese *Myrmica* (The index codes are as indicated in the text)

<table>
<thead>
<tr>
<th>Index</th>
<th><em>M. mirabile</em> (11)</th>
<th><em>M. arisana</em> (5)</th>
<th><em>M. formosae</em> (8)</th>
<th><em>M. serica</em> (9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype</td>
<td>Min-Max</td>
<td>Lectotype</td>
<td>Min-Max</td>
<td>Lectotype</td>
</tr>
<tr>
<td>CI</td>
<td>1.10</td>
<td>1.07-1.12</td>
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<td>1.21-1.26</td>
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<tr>
<td>F1</td>
<td>0.38</td>
<td>0.34-0.39</td>
<td>0.47</td>
<td>0.45-0.47</td>
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<tr>
<td>FL1</td>
<td>1.11</td>
<td>1.11-1.23</td>
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<td>1.07-1.14</td>
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<td>S11</td>
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<td>S12</td>
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<tr>
<td>PI2</td>
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<td>0.44-0.49</td>
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<td>PPI1</td>
<td>0.93</td>
<td>0.84-0.94</td>
<td>0.73</td>
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<td>PPI2</td>
<td>1.00</td>
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<td>PPI3</td>
<td>1.39</td>
<td>1.29-1.40</td>
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<td>ESD1</td>
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<tr>
<td>HTI</td>
<td>0.96</td>
<td>0.91-0.96</td>
<td>0.97</td>
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</tbody>
</table>

of these two species would be rewarding.


Notes: Measurements and indices are given in Tables 1 & 2. Females and males are unknown. M. arisana is clearly related to the rugosid-silvestri complex of Myrmica species and does not belong to the rugosa-group. It differs from Myrmica rugosa Mayr principally by having a head dorsum which is not punctinate, by the shape of its frontal carinae which curve outwards and merge into the rugae which surround the antennal sockets, and by other more minor characteristics. The types of st. tipuna slightly differ from those of M. arisana by their smaller size, slightly more truncated petiolar dorsum and more feeble sculpture of the alitrunk, petiole and postpetiole. But in our opinion, these differences are not sufficient for a separation as species, an opinion which was confirmed by study of additional material from Taiwan (see above). This species may be endemic to Taiwan where little is known of its ecology other than one nest was found by K. Yamauchi living under stone on "herbaceous ground" in southern Taiwan (material studied).

3. Myrmica formosae Wheeler, 1929


Materials examined: Lectotype worker: FENCHIFU (=Funikô), Taiwan (=Formos), Silvestri (MCZ). Paralaectotypes: 9 workers, with same label (MCZ, ZMM). Lectotype worker of M. margaritae var. pulchella Santschi: WUSHE (=Musha), Taiwan (=Formos), K. Sato (BASLE). Paralaectotypes: 2 workers on the same pin.

Notes: Females and males are unknown. This species is recorded only from Taiwan where its ecology is unknown. The status and morphology of M. formosae was discussed in a taxonomic revision of the rita-group (Radchenko and Elmes, 1998), summary measurements and indices are given here for comparison with the other species (Tables 1 & 2).

4. Myrmica serica Wheeler, 1928

Chapman and Capco, 1951: Check List Ants of Asia 127.


Notes: A female of this species was described by Weber (1950) and males by Radchenko and Elmes (1998). The males had relatively short scapes which is considered a primitive character in Myrmica ants. Summary measurements and indices are given here for workers to enable comparison with the other species (Tables 1 & 2). This species is more widespread, having been recorded in southern China and Taiwan. Nothing is known about its ecology except a nest in Taiwan was collected from under a stone on grassland.

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Wheeler, W. M. 1928. Ants collected by


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摘要

台灣已發現4種溫帶性分佈的家蟻屬(Mymica)，除 M. serica Wheeler 外，均僅分佈於台灣島。本文審訂3種記載種(M. formosae Wheeler, M. serica Wheeler 及 M. arisana Wheeler) 與描述1新種(M. mirabile sp. n.)，並附“種”之標本表。M. mirabile 的職蟻體型碩大，為家蟻屬種類所罕見，僅 M. gigantea (Collingwood) 有相似體型。

關鍵詞：台灣、亞洲、分類、新種、家蟻屬。