Zootaxa 2920: 42–64 (2011)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

On the species-group taxa of Taiwanese social wasps (Hymenoptera: Vespidae) described and/or treated by J. Sonan

JUN-ICHI KOJIMA[1,4], FUKI SAITO[2] & LIEN THI PHUONG NGUYEN[3]

[1]*Natural History Laboratory, Faculty of Science, Ibaraki University, Mito 310-8512, Japan. E-mail: jkrte @mx.ibaraki.ac.jp*
[2]*Natural History Laboratory, Faculty of Science, Ibaraki University, Mito 310-8512, Japan. E-mail: fsfsaito@gmail.com*
[3]*Department of Insect Ecology, Institute of Ecology and Biological Resources, Vietnamese Academy of Science and Technology, Hanoi, Vietnam. E-mail: phuonglientit@yahoo.com*
[4]*Corresponding author. E-mail: jkrte@mx.ibaraki.ac.jp*

Table of contents

Abstract

Taiwanese social wasps described and/or treated by Jinhaku Sonan are revised based on specimens housed in the Taiwan Agricultural Research Institute. A checklist of the Taiwanese social wasp species is provided, recognizing 13 *Polistes*, two *Ropalidia*, three *Parapolybia*, eight *Vespa* and three *Vespula* species in the Taiwanese fauna. The lectotypes are designated for *Polistes mandarinus* var. *eboshinus* Sonan, 1943, *Polistes shirakii* Sonan, 1943, *Polistes takasagonus* Sonan, 1943 and *Vespa formosana* Sonan, 1927. *Parapolybia takasagona* Sonan, 1944 is treated as a valid species and its status is resurrected. A key to valid species of Taiwanese *Polistes* is provided. A record of *Vespa* (*Provespa*) *dorylloides* [= *Provespa anomala*] from Taiwan is based on incorrect labeling. The holotypes of *Polistes yamanakai* Sonan, 1937 and *Vespa matsumurai* Sonan, 1935 described from Japan are examined.

Key words: *Polistes*, *Parapolybia takasagona*, *Ropalidia*, *Vespa*, *Vespula*, lectotype, Taiwan, Japan

Introduction

Jinhaku Sonan (1892–1984) was a Japanese entomologist, who lived and engaged in entomological research in Taiwan from 1908 to 1947. His research was mainly on biology of insect pests and their control, but he also described a fair number of species-group taxa in the Lepidoptera and Hymenoptera (mainly parasitic Ichneumonidae), having contributed greatly to understanding of Taiwanese insect fauna (Japanese Society of Applied Entomology and Zoology 1984). Sonan, possibly based on his scientific interest, worked intensively on social wasps; he described 17 nominal species-group taxa in the social wasp subfamilies Polistinae and Vespinae. Of them, three were from Japan [*Polistes yamanakai* Sonan, 1937 (= *Polistes nipponensis* Pérez, 1905); *Vespa matsumurai* Sonan, 1935 (= *Vespa ducalis* Smith, 1852) and *Vespa esakii* Sonan, 1935 (= *Vespa ducalis*)], and one from the Philippines (*Ropalidia horni* Sonan, 1938), and the other 13 were all described from Taiwan. The name-bearing type specimens (holotypes and/or syntypes) of all the 13 taxa described from Taiwan and two from Japan (*Polistes yamanakai* and *Vespa matsumurai*) are in the collection of the Taiwan Agricultural Research Institute at Wofeng (hereafter abbreviated as "TARI"). Sonan did not designate the holotypes for some of his social wasp species-group taxa, and his type specimens (holotypes, paratypes and syntypes) have seldom been referred to in taxonomically proper ways since the original descriptions. Accordingly, taxonomic status, valid or synonymous, of some of Sonan's social wasp taxa has been discussed without referring to the objective references, namely the name-bearing type specimens.

In his review of the Taiwanese social wasps, Starr (1992) failed to properly treat the Sonan's syntypes (for the case of *Polistes formosanus*, see also Saito *et al*. 2007). Yamane *et al*. (1995) referred to the holotype of *Parapoly-*

 Accepted by A. Lelej: 23 May 2011; published: 16 Jun. 2011

bia takasagona Sonan, 1944, which, however, made little contribution to the *Parapolybia* taxonomy, as also shown in this paper.

The purposes of the present study are to (1) explicitly identify the status (holotype or syntype) of the name-bearing type specimens of the Sonan's social wasp nominal species-group taxa, (2) designate the lectotypes, for the stability of the names, of his species-group taxa for which the holotypes were not designated, (3) clarify the taxonomic status (valid or junior subjective synonym) of these nominal species-group taxa, and (4) establish taxonomic bases for further studies of the Taiwanese social wasps.

Material and methods

Social wasp specimens in both the type- and general-collections in TARI were examined to specify the type materials of Sonan's social wasp nominal species-group taxa. Color and external structural characteristics of the specimens that were candidates for the types were examined in comparison with those given in the original descriptions and their label data were examined as well. Information on labels attached to the specimens is given in the following way: Data for each label are given in quotation marks, with a slash (/) indicating the start of a new line. Any comment added by us is given in square brackets. “Type label”, “Paratype label” and “Allotype label” indicate the circular labels that Sonan might have attached to some of his type materials; they respectively have “Type” printed in red and encircled in red (see Saito *et al*. 2007: fig. 1A), “Para- / type” printed in yellow and encircled by yellow, and “Allo- [hand-written with black ink on 'Para-' of Paratype label] / type” printed in yellow and encircled by yellow.

We have added a label that shows the type status of a given specimen (“HOLOTYPE”, “PARATYPE”, “LECTOTYPE” or “PARALECTOTYPE”) and the original citation. Localities are mostly arranged in alphabetical order for easy reference to the locality names listed in the appendix.

Checklist of valid social wasp species recognized in the Taiwanese fauna

The following checklist is mainly based on Starr (1992), with taxonomic/nomenclatural changes made after Starr (1992), including by Kojima & Hagiwara (1998) for *Polistes jokahamae*, Saito *et al*. (2005) for *Polistes tenebricosus* and Saito *et al*. (2007) for *Polistes formosanus*. Aside from the original descriptions, references to the papers of Sonan (1927, 1929, 1935a, 1938, 1943, 1944) and Starr (1992) are given.

For species identifications, Archer's (1989) and Starr's (1992) keys are applicable to vespine species, while a key to *Polistes* species is provided based on that of Starr (1992). In the polistine genus *Ropalidia*, two species, *R. taiwana* and *R. fasciata*, are recognized in the Taiwanese fauna; they can be identified with van der Vecht's (1941) key. The species-level classification of Indo-Papuan *Parapolybia* (Polistinae; Ropalidiini) currently follows that of van der Vecht (1966): two species in the Middle East and three in the Indo-Papuan region. However, *Parapolybia* is in need of revision, and there is reason to believe that many more species exist (F. Saito, unpublished).

Subfamily Polistinae

Tribe Polistini

Genus *Polistes* Latreille

***Polistes* (*Gyrostoma*) *gigas* (Kirby)**
Cyclostoma gigas Kirby in Kirby & Spence 1826: 36.
Polistes (*Gyrostoma*) *confusus* Smith: Sonan 1927: 121.
Polistes gigas Kirby: Sonan 1943: 469–471.
Polistes (*Gyrostoma*) *gigas* Kirby: Starr 1992: 123–124.

***Polistes* (*Gyrostoma*) *jokahamae* Radoszkowski**
Polistes jokahamae Radszkowski 1887: 435.
Polistes hebraeus (Fabricius): Sonan 1931: 6.
Polistes olivaceous (!) (De Geer): Sonan 1943: 477–479.
Polistes (*Megapolistes*) *jadwigae* Dalla Torre: Starr 1992: 122.

***Polistes* (*Gyrostoma*) *rothneyi* Cameron**
Polistes rothneyi Cameron 1900: 410.
Polistes jokahamae Radoszkowski: Sonan 1943: 475–477.
Polistes jokahamae var. *yaeyamae* Matsumura: Sonan 1943: 477–479.
Polistes (*Megapolistes*) *rothneyi* Cameron: Starr 1992: 122.

***Polistes* (*Gyrostoma*) *tenebricosus* Lepeletier**
Polistes tenebricosus Lepeletier 1836: 529.
Polistes tenebricosus Lepeletier: Sonan 1943: 471–472.
Polistes (*Nygmopolistes*) *sulcatus* Smith: Starr 1992: 122–123.

***Polistes* (*Polistella*) *eboshinus* Sonan**
?*Polistes mandarinus* de Saussure 1853: Sonan 1938: 69.
Polistes mandarinus var. *eboshinus* Sonan 1943: 483–484 [lectotype ♀ (here designated) in TARI].
Polistes (*Polistella*) *eboshinus* Sonan: Starr 1992: 128.

***Polistes* (*Polistella*) *formosanus* Sonan**
Polistes formosanus Sonan 1927: 122–125 [lectotype ♀ by designation of Saito *et al*. (2007) in TARI].
Polistes japonicus var. *formosanus* Sonan: Sonan 1943: 479–481.
Polistes (*Polistella*) *japonicus* de Saussure: Starr 1992: 124–126, part.?

***Polistes* (*Polistella*) *huisunensis* Kuo**
Polistes huisunensis Kuo in Kuo & Yeh 1987: 80 [holotype ♂ in the National Chiayi Institute of Agriculture].
Polistes (*Polistella*) *huisunensis* Kuo: Starr 1992: 129–130.

***Polistes* (*Polistella*) *japonicus* de Saussure**
Polistes japonicus de Saussure 1858: 260.
Polistes hengchunensis Kuo in Kuo & Yeh 1987: 80–81 (holotype ♂ in the National Chiayi Institute of Agriculture; synonymized by Starr, 1992).
Polistes shekouensis Kuo in Kuo & Yeh 1987: 81–82 (holotype ♂ in the National Chiayi Institute of Agriculture; synonymized by Starr 1992).
Polistes (*Polistella*) *japonicus* de Saussure: Starr 1992: 124–126, part.

***Polistes* (*Polistella*) *shirakii* Sonan**
Polistes shirakii Sonan 1943: 482–481 [lectotype ♀ (here designated) in TARI].
Polistes (*Polistella*) *shirakii* Sonan: Starr, 1992: 126–127.

***Polistes* (*Polistella*) *stigma* (Fabricius)**
Vespa stigma Fabricius 1793: 275.
Polistes stigmus (Fabricius): Sonan 1943: 473–474.
Polistes (*Polistella*) *stigma* (Fabricius): Starr 1992: 127–128.

***Polistes* (*Polistella*) *strigosus* Bequaert**
Polistes strigosus Bequaert 1940: 269.
Polistes strigosus Bequaert: Sonan 1943: 472–473.
Polistes (*Polistella*) *strigosus* Bequaert: Starr 1992: 126.

***Polistes* (*Polistella*) *takasagonus* Sonan**
Polistes takasagonus Sonan 1943: 482–483 [lectotype ♀ (here designated) in TARI].
Polistes (*Polistella*) *takasagonus* Sonan: Starr 1992: 128.

***Polistes* (*Polistes*) *chinensis* (Fabricius)**
Vespa chinensis Fabricius 1793: 261.
Polistes chinensis (Fabricius): Sonan 1943: 474–475.
Polistes (*Polistes*) *chinensis* (Fabricius): Starr 1992: 131.

Tribe Ropalidiini

Genus *Ropalidia* Guérin-Méneville

***Ropalidia fasciata* (Fabricius)**
Eumenes fasciata Fabricius 1804: 290
Icaria variegata Smith: Sonan 1927: 122.
Ropalidia variegata (Smith): Sonan 1935a: 199–200.
Ropalidia fasciata (Fabricius): Starr 1992: 115–116.

***Ropalidia taiwana* Sonan**
Ropalidia taiwana Sonan 1935a: 201–202 [holotype ♀ in TARI].
Ropalidia taiwana var. *koshunensis* Sonan 1935a: 202 [holotype ♀ in TARI; synonymized by van der Vecht (1941: 143) in ambiguous manner].
Ropalidia formosana Kuo in Kuo & Yeh 1987: 84 [holotype ♂ in the National Chiayi Institute of Agriculture; synonymized under *R. taiwana* by Starr (1992: 116)].
Ropalidia taiwana Sonan: Starr 1992: 116–117.

Genus *Parapolybia* de Saussure

***Parapolybia nodosa* van der Vecht**
Parapolybia nodosa van der Vecht 1966: 25, 39.
Parapolybia takasagona Sonan: Starr 1992: 113–114, part.

***Parapolybia takasagona* Sonan, stat. resurr.**
Parapolybia takasagona Sonan 1944: 344–345 [holotype ♀ in TARI]; Starr, 1992: 113–114, part.

***Parapolybia varia* (Fabricius)**
Vespa varia Fabricius 1787: 293.
Parapolybia varia (Fabricius): Sonan 1944: 343–344; Starr 1992: 112–113.

Subfamily Vespinae

Genus *Vespa* Linnaeus

***Vespa affinis* (Linnaeus)**
Apis affinis Linnaeus 1764: 417
Vespa formosana Sonan 1927: 125–128 [lectotype ♀ (here designated) in TARI; synonymized under *Vespa affinis* (Linnaeus) by Bequaert (1936: 345) and the synonymy was confirmed by Bequaert (1939: 42)]; Sonan, 1929: 145–146.
Vespa affinis (Linnaeus): Starr 1992: 102–103.

***Vespa analis* Fabricius**
Vespa analis Fabricius 1775: 363; Starr, 1992: 103.
Vespa nigrans du Buysson: Sonan 1929: 141–142.

***Vespa basalis* Smith**
Vespa basalis Smith 1852b: 46; Sonan 1929: 144–145; Starr 1992: 103–104.

***Vespa ducalis* Smith**
Vespa ducalis Smith 1852a: 39; Sonan 1927: 128–129; 1929: 138–140; Starr 1992: 104–105.

***Vespa mandarinia* Smith**
Vespa mandarinia Smith 1852a: 38; Starr 1992: 105–106.
Vespa magnifica var. *nobilis* Sonan 1929: 140–141 [holotype ♀ in TARI; treated as a subspecies of *Vespa mandarinia* by van der Vecht (1959:220); synonymized under *Vespa mandarinia* Smith by Starr (1992: 105) in ambiguous manner.]
?*Vespa ducalis* ab. *soror* du Buysson: Sonan 1929: 140.

***Vespa simillima* Smith**
Vespa simillima Smith 1868: 280
[Sung *et al*. (2006) recorded a single queen of this species from Chiayi and considered it as an accidental introduction.]

***Vespa velutina* Lepeletier**
Vespa velutina Lepeletier 1836: 507: Starr 1992: 106–107.
Vespa flavitarsus Sonan 1929: 142–143 [holotype ♀ in TARI; treated as a subspecies of *Vespa velutina* by van der Vecht (1959: 230); synonymized under *Vespa velutina* Lepeletier by Starr (1992: 106) in ambiguous manner.]

***Vespa vivax* Smith**
Vespa vivax Smith in Horne & Smith 1870: 190.
Vespa wilemani Meade-Waldo: Sonan 1929: 146–147 Starr 1992: 107–108.

Genus *Vespula* Thomson

***Vespula arisana* (Sonan)**
Vespa arisana Sonan 1929: 147–148 [holotype ♀ in TARI].
Vespula arisana (Sonan): Starr 1992: 108–109.

***Vespula flaviceps* (Smith)**
Vespa flaviceps Smith in Horne & Smith 1870: 174, 191.
Vespa karenkona Sonan 1929: 148 [holotype ♀ in TARI; treated as a subspecies of *Vespula flaviceps* (Smith) by Yamane *et al*. (1980: 16); synonymized under *Vespula flaviceps* (Smith) by Starr (1992: 109) in ambiguous manner].
Vespa 4-maculata Sonan 1929: 148–149 [holotype ♀ in TARI; synonymized under *Vespula flaviceps karenkona* (Sonan) by Yamane *et al*. (1980: 16)].
Vespula flaviceps (Smith): Starr 1992: 109–110.

***Vespula rufa* (Linnaeus)**
Vespa rufa Linnaeus 1758: 572.
Vespula schrenckii (Radszkowski): Starr 1992: 110.

Taxonomic notes on species-group taxa described and/or recorded from Taiwan by J. Sonan

Below are our taxonomic notes on Sonan's social wasp taxa, including designation of the lectotypes of four species-group taxa, based mainly on examination of specimens in TARI. The names of species-group nominal taxa are those cited by Sonan and the taxa are arranged according to the order given in the above checklist (except for *Vespa* (*Provespa*) *dorylloides*). The currently valid names of the taxa to which the specimens that Sonan examined actually belong are given in brackets.

***Polistes* (*Gyrostoma*) *confusus* Smith 1857 [*Polistes* (*Gyrostoma*) *gigas* Kirby in Kirby & Spence 1826]**

Sonan (1927: 121) mentioned some biological aspects of this species, but he did not indicate where he made his observations.

***Polistes gigas* Kirby 1826 [*Polistes* (*Gyrostoma*) *gigas* Kirby in Kirby & Spence 1826]**

Sonan (1943: 469) mentioned that this species was distributed widely in the island of Taiwan, abundantly occurring in such localities as Sozan and Kuraru.

***Polistes hebraeus* (Fabricius 1878 (!)[1787]) [probably *Polistes* (*Gyrostoma*) *jokahamae* Radoszkowski 1887]**

Sonan (1931: 6) mentioned that *Polistes okinawensis* Matsumura & Uchida, 1926 seemed to be *P. hebraeus*, and that this species was very common in Taiwan Island and was collected also on Hôkotô.

***Polistes olivaceous* (!) (De Geer 1773) [mostly *Polistes* (*Gyrostoma*) *jokahamae* Radoszkowski 1887]**

Sonan (1943: 477), listing *Polistes hebraeus* (Fabricius 1787) and *P. okinawensis* Matsumura & Uchida 1926 as junior synonyms of *P. olivaceus*, stated that this species was common in lowland areas all over Taiwan Island. He listed, as example localities of its occurrence, Heitou, Kagi, Koshun, Rimogan in Bunsan-gun, Souzan and Taihoku. Starr (1992) regarded Sonan's "*P. olivaceus*" as *P. jadwigae* Dalla Torre [= *P. jokahamae*; see Kojima and Hagiwara (1998)]. We have examined 21 ♀ and 11 ♂ in TARI that were identified as *P. olivaceus* by Sonan; they are from Ako, Hokoto (or Bokoto or Hookoto), Horisha, Kagi, Koshun, Nanto, Rimogan and Taihoku. All of them except one *P. rothneyi* ♀ from Kagi were revealed to belong to *P. jokahamae*.

***Polistes jokahamae* Radszkowski 1887 [*Polistes* (*Gyrostoma*) *rothneyi* Cameron 1900]**

Judging from the Japanese name that he used for this nominal taxon, Sonan's (1943: 475) "*P. jokahamae*" seemed to be *P. rothneyi*. Sonan (1943: 475) recorded the following localities: Heito, Hori, Karenko (Domon-Kiraikei), Koshun, Kotosho, Kuraru, Musha, Rikiriki in Choshu-gun (Takao Province), Rono in Kizan-gun (Takao Province), Shinchiku, Sozan and Taihoku. We have examined 58 ♀ and 8 ♂ that have a label showing that Sonan identified them as *P. jokahamae*; they are from Bakulas, Heito, Hori (Horisha), Kagi, Karenko, Koshun, Kotosho, Kuraru, Musha, Rikiriki, Rimogan, Shinchiku, Sozan, Taihoku, and Tompo. All of these specimens were revealed to belong to *P. rothneyi*.

***Polistes jokahamae* var. *yayeyamae* Matsumura 1911 [*Polistes* (*Gyrostoma*) *rothneyi* Cameron 1900]**

Sonan (1943: 477) recorded a female collected in Taipei by Michio Chujo, which is in TARI and labeled "Taihoku / 4 VI 1934 / M. Chujo". The specimen was revealed to belong to *P. rothneyi*.

***Polistes tenebricosus* Lepeletier 1836 [*Polistes* (*Gyrostoma*) *tenebricosus* Lepeletier 1836]**

Sonan (1943: 471) mentioned that this species was rather rare in Taiwan and he had examined 21 ♀ and 5 ♂ from Chikutou, Hatonosawa at the foot of Taiheizan, Hori, Kayahara, Koushun, Musha, Souzan, Taiheizan, Taihoku and Urai (in Bunzan-gun).

***Polistes mandarinus* var. *eboshinus* Sonan 1943 [*Polistes* (*Polistella*) *eboshinus* Sonan 1943]**

Sonan (1943: 483) described *Polistes mandarinus* var. *eboshinus* based on 62 ♀ and 5 ♂ from Arisan, Bakulas, Baron in Shinchiku Province, Bukai in Taichu Province, Doba (foot of Taiheizan), Eboshi (foot of Taiheizan), Funkiko, Karenkou, Matanguru in Taitou, Musha, Oiwake (Musha), Rarasan, Rikiriki in Takao Province, Saukan in Taiheizan, and Taiheizan, but he neither gave any collection data of each specimen nor designated the holotype. Starr (1992) referred to type materials housed in TARI, mentioning "types examined: holotype ♀, 7 paratype ♀, 2 paratype ♂". As Starr (1992) did not give any data that specify the specimen that he referred to as "holotype", his statement does not constitute valid lectotype designation [Article 74.5 of the Code (ICZN 1999)].

In TARI, we located 54 ♀ and 6 ♂ that are, judging from the collection data and attached Sonan's identification labels, from the type series. However, the number of the male specimens (six) is larger than that given in Sonan (five). Eight ♀ and 2 ♂ that possess Type/Paratype/Allotype labels could be the specimens that Starr (1992) referred to as type materials. The type series certainly included two distinct species; the species to which the specimens marked with asterisks belong might be "sp. A" in Starr (1992) and could be an undescribed species.

Type material. LECTOTYPE of *Polistes mandarinus* var. *eboshinus* Sonan, 1943 (here designated): ♀ labeled "Taiheizan / 26 VIII 1923 / Col. J. Sonan", "*Polistes mandarinus* / Sauss. var. ♀ / *eboshinus* Sonan / DET. J. SONAN" and "*POLISTES* / *EBOSHINUS* / Sonan / Det. Starr, 1991". PARALECTOTYPES: **In drawer 93–23**: 1 ♂, "Funkiko / 16 XI 1926 / Col. J. Sonan", Allotype label, "*Polistes mandarinus* / Sauss. var. ♂ / *eboshinus* Sonan / DET. J. SONAN", "132"; 1 ♀, "Formosa / Musha, 1919. / V 18–VI 15. / T. Okuni, / J. Sonan, / K. Miy., M. Yosh.", "*Polistes mandarinus* / Sauss. ♀ / *eboshinus* Sonan / DET. J. SONAN", Paratype label, "130"; 1 ♀, "Formosa / Musha, 1919. / V 18–VI 15. / T. Okuni, / J. Sonan, / K. Miy., M. Yosh.", "*Polistes mandarinus* / Sauss. ♀ / *eboshinus* Sonan / DET. J. SONAN", Paratype label, "130"; 1 ♀, "Namakaban / 19.IX.1924 / T. Shiraki / J. Sonan", Paratype label, "*Polistes mandarinus* / Sauss. ♀ / *eboshinus* Sonan / DET. J. SONAN", "131"; 1♀, "Saukan / Taiheizan / 16–18 VII 1938 / J. Sonan", Paratype label, "*Polistes mandarinus* / Sauss. ♀ / *eboshinus* Sonan / DET. J. SONAN", "129"; 1 ♂, "Taiheizan / VII 20. 1935 col. J. Sonan", Paratype label, "*Polistes mandarinus* / Sauss. var. ♂ / *eboshinus* Sonan / DET. J. SONAN", "133"; 3 ♀ [in addition to the following labels, one with Type label and "124", and the other two with Paratype label, and "125" or "128"], "Takeyama / 16 V 1926 / Co. J. Sonan", "*Polistes mandarinus* / Sauss. ♀ / *eboshinus* Sonan / DET. J. SONAN"; 2 ♀ [these 2 ♀ specimens apparently belong to a species different from that of the lectotype; their specific affiliation await future taxonomic studies], "Eboshi / Taiheizan / 12–14 VII 1938 / J. Sonan", Paratype label, "*Polistes mandarinus* / Sauss. ♀ / *eboshinus* Sonan / DET. J. SONAN", "126" [or "127'], "*Polistes* (*Polistella*) / spec. / Det. S. Yamane". **In drawer 94–08** (all the paralectotypes in this drawer except one indicated by "[without ID label]" have a label "*Polistes* ♀ [or "♂" accordingly] / *mandarinus* Sauss. / var. *eboshinus* Sonan / Det. J. Sonan"): 1 ♀, "Formosa / Arisan, 1918. / X 2–23. / J. Sonan / M. Yoshino"; 1 ♂, "Arisan / 191[?].X.10 / Col. I. Nitobe"; 1 ♀, "14 / IV 1910 / Bakulas / Col. I. Nitobe"; 2 ♀ "Formosa / Karenko, -19. / VII 20–VIII 4, / T. Okuni, / J. Sonan, / K. Miy., M. Yosh."; 1 ♀, "Baron / FORMOSA / 10 IV 1941 / Col. J. Sonan"; 1 ♀, "Bukai / FORMOSA / 28 VIII 1940 / Col. J. Sonan"; 1 ♀, "Dobo / 19 VII 1935 col. J. Sonan"; 1 ♀ "Rikiriki / 20.III.1924 / N. Takeda"; 1 ♀, "Funkiko / 16 XI 1926 / J. Sonan"; 1 ♀, "Matanguru / Kanzangoe / 28.VI.1936 / Col. R. Takahashi"; 3 ♀, "Formosa, / Musha, 1919. / V 18–VI 15, / T. Okuni, / J. Sonan, / K. Miy., M. Yosh."; 1 ♀, "Rakurku / 18.IX.1924 / T. Shiraki / J. Sonan"; 1 ♀, "Rato / 18. VII 1935 col. J. Sonan"; 1 ♀, "Saukan / Taiheizan / 16–18 VII 1938 / J. Sonan"; 1 ♀ [without ID label], "Taiheizan / FORMOSA / 30 VII 1935"; 1 ♀, "Taiheizan / 20 VII 1938 / J. Sonan"; 1 ♀, "Taiheizan / 21 VIII 1935 / T. Hiwatari"; 1 ♀, "Taiheizan / 26.VIII 1927 / Col. J. Sonan"; 1 ♀, "Taiheizan / 27 IV 1935 col. J. Sonan"; 1 ♀, "Taiheizan / III-30-1936 / Col. J. Sonan"; 1 ♀, "Taiheizan / VII. 21. 1935 col. J. Sonan"; 1 ♂, "Taiheizan / VII 21 1935 col. J. Sonan"; 2 ♀, "Taiheizan / 5.VI. 1937 / Col. Ikeda Narumi [collector's name given in Chinese characters]"; 2 ♂, "Taiheizan / 20.V.1935 col. J. Sonan"; 6 ♀, "Taiheizan / VII. 20. 1935 col. J. Sonan"; 1 ♀* [headless, pinned with

a small nest], “14/IV 1910 / Bakulas / Col. I. Nitobe”; 2 ♀*, “Dobo / 19 VII 1935 col. J. Sonan”; 5 ♀*, “Eboshi / Taiheizan / 12–14 VII 1938 / Col. J. Sonan”; 1 ♀*, “Formosa / Karenko, -19. / VII 20–VIII 4. / T. Okuni, / J. Sonan, / K. Miy., M. Yoshi”; 2 ♀*, “Rato / 18 VII 1935 col. J. Sonan”; 1 ♀*, “Taiheizan / 20 VII 1935 col. J. Sonan”; 1 ♀*, “Formosa / Musha. 1919 / V 18–VI 15 / T. Okuni, / J. Sonan, / K. Miy., M. Yoshi”.

Polistes mandarinus de Saussure 1853 [probably *Polistes* (*Polistella*) *eboshinus* Sonan 1943]

Sonan (1938: 69) listed 1 ♀ with the collection data “Taihorin, vi.1911 (H. Sautter)” and deposited in the Deutsches Entomologisches Institut. He mentioned “this species is common in Formosa.” This statement was probabaly based on the type series of *Polistes mandarinus* var. *eboshinus* Sonan, 1943; all type specimens we located in TARI had been collected before the year 1938.

Polistes formosanus Sonan 1927 [*Polistes* (*Polistella*) *formosanus* Sonan 1927]

Sonan (1927) described this species based on females (body length 16 mm, wingspan 30 mm, fore wing length 14 mm) and male(s) (body length 16 mm, wingspan 40 mm, fore wing length 18.5 mm) from Horisha, Jukirin (Shinchiku), Kan-shirei, Keibi, Namakaban (Niitaka-yama), Rikiriki, Sôzan, Taihoku and Urai. He, however, gave neither number of specimens he examined nor any collection data for each specimen. Saito *et al.* (2007) designated a female specimen collected in “Taihoku” as the lectotype of *Polistes formosanus* Sonan, 1927; the only specimen from the type series available to them at that time. Saito *et al.* (2007) provided a picture showing all the labels accompanying the lectotype and detailed description of adult morphology. In TARI, we located the following specimens that could be from the type series, and thus are paralectotypes. Based on their morphological characteristics they all could belong to *Polistes formosanus*.

Type material. PARALECTOTYPES of *Polistes formosanus* Sonan, 1927 (all specimens except for the first one have the Sonan's identification label “*Polistes* ♀ [or ♂ according to the sex] / *japonicus* Sauss. / var. *formosanus* Son. / Det. J. Sonan”): 1 ♀, “Jukirin / 24.v.1919 / Col. S. Inamura”; 1 ♀ “Kanshirei / 10.xi.1926 / Col. J. Sonan”; 1 ♀, “KEIBI / 14 IV 1921 / S. TOKUNAGA”; 1 ♀, “Namakaban / 10.IX.1924 / T. Shiraki / J. Sonan”; 1 ♀ “Rikiriki / 20 III 1924 / N. Tokuda”; 1 ♀, “Sozan / 24.9.1926 / Col. J. Sonan”; 1 ♀ “Sozan / 27.x.1926 / Col. J. Sonan” ; 1 ♂, “Sozan / 19.x.1922 / N. Takeda”; 1 ♀, “Taihoku / 17 VIII 1925 / Col. J. Sonan” and “*Polistes* / *formosana* Sonan / DET. J. Sonan”; 5 ♀, 1 ♂, “Taihoku / 16 VII 1925 / Col. J. Sonan”; 1 ♀, “Taihoku / 14 VII 1925 / Col. J. Sonan”; 1 ♀, “IX.1912 / Taihoku / Col. I. Nitobe” and “3155”.

Sonan (1938) downgraded his *Polistes formosanus* to a variant of *P. japonicus* de Saussure, 1858, and listed 25 ♀ and 4 ♂ (all in the Deutsches Entomologisches Institut) from Horisha, Kankau, Kosempo, Taihorin, Takao and Paroe (in Taito Prefecture). At the same time, Sonan (1938) proposed “*Polistes japonicus* var. *formosanus* f. *koshunensis*” based on the “holotype” ♀ and 3 ♀ collected by H. Sauter in Kankau (deposited in the Deutsches Entomologisches Institut, but one “paratype” in TARI) and 22 ♀ from Garanbi, Kankau, Koshun, Kuraru, Kurau, Makazayazaya (in Heito-gun), Taihoku and Urai. The name “*koshunensis*” is unavailable under Article 45.5 of the Code, and thus these specimens have no type status.

Polistes shirakii Sonan 1943 [*Polistes* (*Polistella*) *shirakii* Sonan 1943]

Sonan (1943) described *Polistes shirakii* based on 19 ♀ and 3 ♂ from Heitou, Hori, Kanshirei, Musha, Rokki and Taihoku, but he did not designate the holotype. Starr (1992) referred to type materials housed in TARI as “types examined: holotype ♀, 2 paratype ♀, 4 paratype ♂”, but he did not give any data that specify the specimen that he referred to as “holotype” and thus this does not constitute valid lectotype designation (Article 74.5 of the Code). In TARI, we located the following 3 ♀ and 4 ♂ collected in Taihoku, which seem to be those referred to by Starr (1992). Although the number of the male specimens (four) is larger than that Sonan gave (three), judging from their label data, these specimens are highly probably from the type series.

The specimens examined are as follows, and the first-listed specimen is here designated as the lectotype of *Polistes shirakii* Sonan, 1943. Other specimens are paralectotypes.

Type material. LECTOTYPE (designated here): ♀ labeled "Taihoku / 6 IX 1925 / Col. J. Sonan", "*Polistes* ♀ / *shirakii* Sonan / DET. J. SONAN", Paratype label, and "135". PARALECTOTYPES: 1 ♂, "Taihoku / 8 VIII 1925 / Col. J. Sonan", "No Polistes / 10", "*Polistes* ♂ / *shirakii* Sonan / DET. J. SONAN", Paratype label, and "138"; 1 ♂, "Taihoku / 10 IX 1929 / Y. Horikawa", "*Polistes* ♂ / *shirakii* Sonan / DET. J. SONAN", Paratype label, and "140"; 2 ♂, "Taihoku / 8 VIII 1925 / Col. J. Sonan", "No Polistes / 10", "*Polistes* ♂ / *shirakii* Sonan / DET. J. SONAN", and Allotype label and "137" [or Paratype label and "139"]; 2 ♀, "Taihoku / 8 VIII 1925 / Col. J. Sonan", "No Polistes / 10", "*Polistes* ♀ / *shirakii* Sonan / DET. J. SONAN", and Type label and "134" [or Paratype label and "136"].

Polistes stigmus (Fabricius 1793) [*Polistes* (*Polistella*) *stigma* (Fabricius 1793)]

Sonan (1943: 473), without giving collection data for each specimen he examined, referred to Heichin, Heitou, Kobi (Gokenseki) and Takao as localities specimens from which he examined, and mentioned that this species was rare in northern part of Taiwan and common in Takao and Heitou. In TARI, we located 6 ♀ and 1 ♂ with Sonan's identification label and collected before the year 1943: 1 ♀ from Heichin, 3 ♀ and 1 ♂ from Heito, and 2 ♀ from Takao. These specimens belong to *P. stigma* in the currently accepted sense. In addition to them, TARI houses a female *P. stigma* collected in Gokenseki in 1909, which may have also examined by Sonan when he prepared his 1943 paper.

Polistes strigosus Bequaert 1940 [*Polistes* (*Polistella*) *strigosus* Bequaert 1940]

Sonan (1943: 472) recorded 4 ♀ under *P. strigosus*, all of which are in TARI. Each of them had the following label of collection data: "Hatonosawa / Taiheizan / 15.VII.1938 / J. Sonan"; "Rahau / Taihoku / 13.VII.1939 / J. Sonan"; "Taihei-zan / 20.VII.1935 coll. Ikeda Narumi [in Chinese characters]"; "TAIKO / 20.VII.1930 / J. Sonan".

Polistes takasagonus Sonan 1943 [*Polistes* (*Polistella*) *takasagonus* Sonan 1943]

Sonan (1943) described *Polistes takasagonus* based on 89 ♀ and 5 ♂ collected at various localities in Taiwan, such as Arisan, Chipon, Giran, Hassen-zan, Heichin, Kappan-san, Karenkou, Koushun, Kuraru, Naifunbo, Naro, Riyohen, Shinchiku, Taipei, Taitou, Takeyama and Urai. In TARI we located 5 ♀ and 4 ♂ that have Type or Paratype labels, which would be the specimens that Starr (1992: 128) erroneously referred to "holotype ♀, 4 paratype ♀, 4 paratype ♂". In addition to them, we located 26 ♀ that are highly possibly from the type series. The female specimen from "Heichin" and with Type label is here designated as the lectotype of *Polistes takasagonus* Sonan, 1943, and remaining 30 ♀ and 4 ♂ are paralectotypes.

Type material. LECTOTYPE (designated here): ♀ labeled "Heichin / 30 VI 1936 / Col. J. Sonan", Type label, "*Polistes* ♀ / *takasagonus* / Sonan / DET. J. SONAN", and "141". PARALECTOTYPES: 1 ♀, "Formosa / Arisan, 1918 / X 2–23. / J. Sonan, / M. Yoshino"; 1 ♀, "Giran / 29 VII 1928 / Col. J. Sonan"; 3 ♀, "7 VI 1914 / Taito / I. Nitobe"; 1 ♀, "Hassen-zan / FORMOSA / 8.VI.1941 / Col. J. Sonan"; 2 ♀, "NARO / 21.VIII –1928 / Col. J. Sonan"; 1 ♂ "Kaguhara (Taipei) / 3 IX 1929 / Col. J. Sonan", Allotype label, "No 1 ♂", "*Polistes* ♂ / *takasagonus* / Sonan / DET. J. SONAN", and "146"; 1 ♀, "Kappanzan / 16 V 1930 / Col. J. Sonan"; 2 ♀, "Formosa / Koshun, 1918 / IV 25–V 25. / J. Sonan / K. Miyake, / M. Yoshino"; 1 ♀, "Kuraru / 13 X 1926 / Col. J. Sonan"; 1 ♂ [metasoma missing] "Makazayazaya / 9. X. 1926, Heito / Col. J. Sonan", Paratype label, "*Polistes* ♂ / *takasagonus* / Sonan / DET. J. SONAN", and "147"; 1 ♀, Paratype label, "Mizuho / 29 VII 1942 / Col. C. Matsuda", "*Polistes* ♀ / *takasagonus* / Sonan / DET. J. SONAN", and "142"; 1 ♀, "Naihunpo / 19 IX 1924 / T. Shiraki / J. Sonan", "*Polistes* Sauss / *mandarinus* / Det. T. Shiraki", Paratype label, "*Polistes* ♀ / *takasagonus* / Sonan / DET. J. SONAN", and "144"; 1 ♀, "RIYOHEN – RATO / SEPT–5–1929 / R. TAKAHASHI"; 1 ♀, "Formosa / Shinchiku, –18, / VII. 1–30. / J. Sonan / K. Miyake"; 1 ♀, "Shinchiku / 9.X.1928 / Col. J. Sonan"; 1 ♀, "Mizuho / 30.VII 1942

/ Col. C. Matsuda"; 2 ♀, "Taihoku / 24 VI 1926 / Col. J. Sonan"; 2 ♀, "Taihoku / 29 VI 1926 / Col. J. Sonan"; 1 ♂ "Taihoku / 1 VIII 1925 / Col. J. Sonan", "No. Polistres / 9", Paratype label, "*Polistes* ♂ / *takasagonus* / Sonan / DET. J. SONAN", and "149"; 1 ♂, "TAIHOKU / FORMOSA / 25 VI 1938 / COL. J. SONAN", "No 21", Paratype label, "Polistes ♂ / takasagonus / Sonan / DET. J. SONAN", and "148"; 1 ♀, "Taihoku / 1 VIII 1925 / Col. J. Sonan";1 ♀, "Taihoku / FORMOSA / 25 VI 1938 / COL. J. SONAN"; 2 ♀, "Chipon / 20 VI 1943 / Col. J. Sonan"; 1 ♀, "12 / IX 1910 / Taipin / Col. T. Shiraki", "3155", "*Polistes* Sauss / *mandarinus* / Det. T. Shiraki", Paratype label, "*Polistes* ♀ / *takasagonus* / Sonan / DET. J. SONAN", and "145"; 2 ♀, "Formosa / Taito, 1919 / II 25–III 27 / S. Inamura, / J. Sonan, / M. Yoshino"; 1 ♀ [body largely discolored; pedicel and flagellum of right antenna missing], "Urai / 18 X 1925 / Col. J. Sonan", "*Polistes* Sauss / *mandarinus* / Det. T. Shiraki", Paratype label, "*Polistes* ♀ / *takasagonus* / Sonan / DET. J. SONAN", and "143".

Polistes chinensis Fabricius 1793 [*Polistes* (*Polistes*) *chinensis* Fabricius 1793]

Sonan (1943: 474) recorded this species from Heichin, Kozan (in Shinchiku-gun), Rokki (in Heito-gun), Sansei (in Rato-gun), Taihoku, Tamazato (Karenkou), and Yûsho.

Icaria variegata (Smith 1852) [*Ropalidia fasciata* (Fabricius 1804)]

Sonan (1927: 122), without giving any locality record, listed "*Epipona variegata* Smith", "*Icaria picta* Sauss." and "*Icaria ferruginea* Matsumura (nec Fabricius)" as synonyms of *Icaria variegata*, and mentioned that this species could be distinguished from *I. ferruginea* by having paired yellow lateral spots on the second metasomal segment. Sonan (1935a: 199) listed, as synonyms, "*Epipona variegata* Smith, 1852 [1852c]", "*Icaria variegata* Smith" of de Saussure (1853), Smith (1857), Dalla Torre (1894, 1904), and Bingham (1897), "*Ropalidia variegata*" of Bequaert (1918) and Yano (1932), "*Icaria picta* de Saussure" of de Saussure (1854) and Kuroiwa (1926), "*Icaria pendula* Smith, 1857", and "*Icaria ferruginea*" of Matsumura (1908, 1910), Kuroiwa (1908) and Matsumura & Uchida (1926). Sonan (1935a) mentioned that this species was common in Formosa (=Taiwan) and Okinawa, and recorded the following localities in Taiwan: Batoran (Karenko), Choshu, Heito, Kagi, Koshun, Kotosho (Botel-Tobago), Nanto, Raisha, Rokki, Sankaikeki, Shinchiku, Taihoku, Tainan, Taito and Urai.

Ropalidia taiwana Sonan 1935 [*Ropalidia taiwana* Sonan 1935]

Sonan (1935a) described this species based on the holotype ♀ and 5 ♀ and 1 ♂ paratypes. All these type specimens are in TARI and their label data given below agreed with those given in the original description.

Type material. HOLOTYPE ♀: "Formosa / Shinchiku, -18. / VII 1-30. / J. Sonan, / K. Miyake", "*Ropalidia* / *taiwana* / Sonan / DET. J. SONAN", "96", Type label. PARATYPES: 1 ♀, same collection label as holotype; 1 ♀ (possibly pre-adult pupa taken from a nest) "Hori / 20.XI.1932 / Col. J. Sonan"; 1 ♀ "Hassenzan / 23.X.1932 / K. Nomura"; 1 ♂ "Horisha / 2.XII.1916 / Col. T. Shiraki"; 1 ♀ "Formosa / Koshun, 1918 / IV 25–V 25. / J. Sonan / K. Miyake, / M. Yoshino"; 1 ♀ "Urai / VII – 1931 / Col. J. Sonan".

Ropalidia taiwana var. *koshunensis* Sonan 1935 [*Ropalidia taiwana* Sonan 1935]

Sonan (1935a) listed the female from "Kuraru (Koshun)" as the holotype, and 11 ♀ and 4 ♂ paratypes. In TARI, there are, as listed below, the holotype ♀ and 9 ♀ and 6 ♂ specimens marked as "Allotype" or "Paratype". Sonan (1935a: 202), as the allotype and paratypes collected in Kuraru on "Oct. 13 1926" and "Oct. 14 1926", listed 6 ♀ and 4 ♂ and 3 ♀, respectivey. The recognized discrepancy between the number of specimens given in the original description and that actually exist in TARI could have been because of incorrect labeling or a misprint. Also, Sonan (1935a: 202) listed a specimen with collection data "Koshun, March 25 1930" as female, but it is actually male.

Type material. HOLOTYPE ♀: "Kuraru / 13.X.1926 / Col. J. Sonan", "*Ropalidia* / *taiwana* Sonan / var. *formosensis* / Sonan / DET. J. SONAN", Type label, "97". PARATYPES: 6 ♀, 5 ♂ same collection data label as holotype; 2 ♀, same collection label as hoplotype but "14.X.1926"; 1 ♀ "Koshun 1918 / IV.25–V.25 / J. Sonan / K. Miyake / M. Yoshino"; 1 ♂ "KOUSHUN / 25.III.1930 /Col. T. Shiraki". :

Parapolybia takasagona Sonan 1944 [*Parapolybia takasagona* Sonan 1944]

Among Sonan's social wasp taxa, this one needs special attention to discuss its taxonomic status. Our conclusion, as outlined below, treating *Parapolybia takasagona* as a valid species is tentative. In order to establish a well corroborated species-level taxonomic system of the *Parapolybia indica* group, to which *P. takasagona* belongs, further intensive studies that covers various "populations" are required.

Sonan (1944) recognized four nominal species in *Parapolybia* occurring in the territories of the Japanese Empire of that time. They were: *P. varia* (Fabricius 1787), which Sonan considered to occur in Taiwan and main islands of Japan; *P. disticha* (du Buysson 1913) [currently treated as a synonym of *P. varia* (van der Vecht 1966), although its taxonomic status needs further careful examination (F. Saito, unpublished)], which Sonan considered to occur in the Korean Peninsular; *P. indica* (de Saussure 1854) in Japan; and *P. takasagona*. Sonan (1944) described *P. takasagona* based on the holotype ♀ collected at Tamaru in Rato District, and 6 ♀ and 6 ♂ paratypes. In TARI, there are the holotype and 6 ♀ and 5 ♂ paratypes; Sonan (1944) mentioned 3 ♂ from "Kobayashi, Rato", but one of them was not located.

Type material. Holotype ♀: "Tamaru (Rato) / 30 VIII 1923 / Col. J. Sonan", Type label, "*Parapolybia* / *takasagona* / Sonan / Det. J. Sonan" and "78", is hardly considered to be discolored in contrast to Starr's (1992) and Yamane *et al.*'s (1995), and it well matched the original description (Sonan 1944). The labels of collection data for female paratypes are as follows: 2 ♀, "Tabo (Rato) / 24 VIII 1923 [1 ♀: 22 VIII 1923] / Col. J. Sonan"; 1 ♀, "Kobayashi / (Rato) 29 VIII 1923 / Col. J. Sonan"; 1 ♀ with "Arisan / 2.V.1917 / Col. T. Shiraki"; and 2 ♀, "Taiheizan /FORMOSA / Jul.1930 / S. Minowa". The two female paratypes from "Tabo" have the occipital carina evanescent ventrally and certainly belong to a species different from that to which the holotype belongs. One of the two female paratypes from "Taiheizan" has yellow markings brighter and more abundant than the holotype and the specimen may possibly belong to a different species. The condition and the label data for the five male paratypes are as follows: 3 ♂ (1 ♂: second to terminal flagellomeres of the right antenna and fourth to terminal flagellomeres of the left antenna missing; 1 ♂: metasoma except the first segment, fourth to terminal flagellomeres of the right antenna and fifth to terminal flagellomeres of left antenna, missing [Sonan may have used this male for genital observation]), labeled "Kobayashi / (Rato) 28 VIII 1923 / Col. J. Sonan"; 1 ♂ (third to terminal flagellomeres of both antennae missing), labeled "Taiheizan / 26 VIII 1923 / Col. J. Sonan"; and 1 ♂ with a label of "Taiheizan / 25 VIII 1923 / Col. J. Sonan".

Starr (1992) examined these type specimens in TARI and concluded that *P. takasagona* is a valid species, differing from *P. varia* (Fabricius 1787). He treated *P. takasagona* as the senior sysnonym of *P. nodosa* van der Vecht, 1966, which was described based on the holotype ♀ collected at Pilam [= Beinan, ca. 22°45' N, 121°01' E] in Taiwan and the female paratypes from four other localities in Taiwan, and Burma (Tenasserim), China (Fukien), India (Umbaso) and Thailand. However, Starr (1992) referred neither to the conditions of female occipital carinae in type specimens of *P. takasagona* nor to that given in the original description of *P. nodosa*. That is, the female occpital carina is complete in the holotype of *P. takasagona* while it is obliterated ventrally in *P. nodosa* (van der Vecht 1966: 23).

Yamane *et al*. (1995) examined the holotype of *P. takasagona* and concluded that *P. takasagona* was a junior synonym of *P. indica* (de Saussure 1854) because "The holotype specimen [of *P. takasagona*] has complete occipital carina on gena, which is the most reliable characteristic that constantly separates *P. indica* from the other Oriental congeners [*P. varia* and *P. nodosa*]." Another reason for their synonymy was that "the occurrence of *P. indica* in Taiwan has been strongly suggested by a female specimen collected by Dr. Kenji Ohara near Hsitsun, Taoyuan (1000–1200 m alt.) and three female specimens housed in the Department of Zoology, Taiwan Museum (Taipei)." They also mentioned that "the structural characteristics [of the holotype of *P. takasagona*] well agree with those [= structural characteristics of *P. indica*] mentioned by Vecht (1966)." However, the female structural characteristics that van der Vecht (1966) mentioned are only "Occipital carina complete, extending to the base of the mandi-

bles. Length (h. + th. + t.1 + 2): 14–17 mm, rarely only 13 mm" (p. 23). Yamane *et al*. (1995) referred to the color pattern of the holotype of *P. takasagona* that it is "in accordance with that of *P. indica*", but they did not mention to which of van der Vecht's (1966) subspecies or forms their "*P. indica*" corresponded. Yamane *et al*. (1995) also mentioned that "Sonan's description of male antenna undoubtedly shows that the males examined by him are also of *P. indica*." This statement might have been made by referring to van der Vecht (1966); but the male characteristics of *P. indica* given in van der Vecht (1966: 23) are only "Antennae long and slender, the third and fourth segments more than six and four times as long as wide, respectively." Thus Yamane *et al*.'s (1995) synonymy was based on poor grounds and *Parapolybia takasagona* Sonan should be treated as a valid species at least until the concepts of *P. indica* and nominal species-group taxa that are now treated as subspecies of *P. indica* are established.

Parapolybia varia (Fabricius 1787) [?*Parapolybia varia* Fabricius 1787, ?*Parapolybia nodosa* van der Vecht 1966]

Sonan (1944) recorded this nominal species from Chipon, Eboshi, Hokuto, Kanko, Kobayashi (Rato), Koshun, Kuraru, Kusukusu, Namakaban, Rato, Sozan, Tabo, Taihoku, Taiko, Taito, Tonbo and Urai. We have not yet determined the specimens that Sonan examined; they may include both *P. varia* and *P. nodosa*, and possibly another nominal species that is currently treated as a junior synonym of *P. varia*.

Vespa formosana Sonan 1927 [*Vespa affinis* Linnaeus 1764]

Sonan (1927) did not designate the holotype when he described this nominal taxon based on queen(s) [body length 28 mm; wing span 50 mm; fore wing length 21 mm], worker(s) [body length 22 mm; wing span 35 mm; fore wing length 16 mm] and male(s) [body length 21 mm; wing span 41 mm; fore wing length 18 mm] from "Taihoku, Kagi, Takezaki, Nanto, Daimokko, Maruyama". Starr (1992: 102) mentioned "types examined: 1 queen, 1 worker, 1 ♂", which does not constitute lectotype designation.

Type material. In TARI, we located only the following specimens that could be from the type series of *Vespa formosana.* LECTOTYPE (designated here): one queen (body length 28 mm; wing span 46 mm; fore wing length 20 mm), with labels of Type label, "Taihoku / 3.VII 1926 / Col. J. Sonan", "Vespa formosana / Sonan", and "161". PARALECTOTYPES: one worker (body length 21 mm; wing span 33 mm; fore wing length 16 mm), with Type label, "♀ type", "Kagi / 14 VI 1926 / Toyota", "Vespa formosana / Sonan" and "162"; and 1 ♂ (body length 19 mm; fore wing length 18 mm), with Type label, "type ♂", "Vespa formosana / Sonan", and "163" but without any collection data label. These specimens could be those that Starr (1992) refered to as "types examined".

Sonan (1929) listed the following specimens that he examined: 1 worker, Dakusui (Ratô), 4.XI.1928 (J. Sonan); 1 worker, Fukô, 1.VII.1925 (J. Sonan); 1 worker*, Kagi, 25.VI.1926 (K. Toyota); 2 workers*, Kagi, 10.VI.1926 (K. Toyota); 1 worker*, Kagi, XI.1923 (M. Kato); 1 queen*, Kagi, 24.VII.1924 (K. Toyota); 1 queen*, Nanto, IV.1910 (G. Toba); 1 queen*, Nanto, IV.1910 (T. Shiraki); 1 worker, Sozan, 29.IX.1926 (J. Sonan); 1 worker*, Taihoku, 27.VIII.1908 (I. Nitobe); 1 worker*, Taihoku, 28.II.1913 (S. Inamura); 1 queen*, Taihoku, XI.1912 (I. Nitobe); 1 queen, Taihoku, 23.V.1928 (J. Sonan); 1 queen*, Taihoku, VII.1925 (J. Sonan); 1 queen*, Taihoku, 5.VI.1908 (I. Nitobe); 1 queen*, Taihoku, 3.VII.1[9]26 (J. Sonan); 1 queen*, Taihoku, XI.1912 (I. Nitobe); 2 workers*, Taihoku, 30.VIII.1925 (J. Sonan); 1 worker*, Takezaki, 15.IX.1926 (J. Sonan). Among these specimens those with asterisks had been collected before year 1927 when the original description of *Vespa formosana* was published, and at the localities mentioned in the original description; they could be examined by Sonan when he prepared the original description. However, Sonan (1927) did not mention any variation in color pattern or morphology, and thus we conclude that the original description was based on the three specimens (one queen, one worker and one male) with the Type labels. The queen specimen from "Taihoku" that has a label of specimen number "161" is here desiganated as the lectotype of *Vespa formosana* Sonan 1927. The worker from "Kagi" (specimen number "162") and the male with specimen number "163" are paralectotypes.

Bequaert (1936: 345), on the strength of the original descriptions and specimens from "Takao" and "Hu Sia" [unrecognized locality], synonymized this nominal taxon under *Vespa affinis* (Linnaeus). Later he (Bequaert 1939: 42) confirmed his own synonymy, mentioning "Dr. K. Yasumatsu sent me recently a specimen of what is called *V.*

formosana by Japanese entomologists." However, Bequaert's synonymy has long been overlooked. Van der Vecht (1957, 1959) did not refer to this synonymy, Kuo (1984) and Kuo & Yeh (1987) used *V. formosana* to describe ecological aspects of this species, and finally Starr (1992) referred to Sonan's types and recognized the synonymy of *V. formosana* with *V. affinis* but did not refer to Bequaert's synonymy. The lectotype (and also paralectotypes) of *Vespa formosana* here designated belongs to *V. affinis* and the synonymy of Bequaert (1936) has been confirmed.

Vespa nigrans du Buysson 1903 [*Vespa analis* Fabricius 1775]

Sonan (1929: 141) listed the following specimens: 1 queen and 2 workers, Arisan, 2–23.X.1918 (J. Sonan, M. Yoshino); 2 workers, Horisha, V–VIII.1918 (H. Kawamura); 1 worker, Karenkô, 20.VII–4.VIII.1919 (T. Okuni, J. Sonan, K. Miyake, M. Yoshino); 1 queen, Musha, 18.V–15.VI.1919 (T. Okuni, J. Sonan, K. Miyake, M. Yoshino); 1 worker, Shinchiku, 1–20.VII.1918 (J. Sonan, K. Miyake); 2 queens and 31 workers, Taihoku, 21.VII.1925 (J. Sonan); 1 queen, Yûsho (near Piyanan-anbu) (6000 ft), 3.XI.1928 (J. Sonan). We did not examine these specimens, but judging from Sonan's description of body size and marking pattern his specimens could all belong to *V. analis*. Sonan (1929) also referred to the median tooth in the apical emargination of female clypeus, the most pronounced characteristic of *Vespa analis*; but it is notable that Sonan mentioned that some specimens lacked this tooth [it was possibly rudimentary but not completely disappeared]. The size of the median tooth is known to be variable (Bequaert 1939: 37; van der Vecht 1957: 4), occasionally even "small or rudimentary."

Starr (1992: 103, fig. 16) mentioned that *V. analis* "is known only from a few medium-elevation localities in the central part of the island [=Taiwan]", but among the localities recorded by Sonan, "Karenkô", "Shinchiku" and "Taihoku" are low-elevation localities.

Vespa basalis Smith 1852 [*Vespa basalis* Smith 1852]

Sonan (1929: 144) mentioned that this species was common in mountainous areas in Taiwan, and recorded it from Arisan, Bakuras (Karenkô), Heito, Rônô, Horisha, Kobayashi, Musha, Rikiriki, Rimogan, Tabô, Taihoku, Taipin, Taito, and Ugan (Rato).

Kuo and Yeh (1985) metioned that this species might make its initial nest in a cavity or low vegetation and relocate the nest high in a tree when a colony has produced a certain number of workers. Sonan (1929: 145) stated that he saw hornets going in and out of a small hole on the ground (a nest was under the ground) at Jûjiro [= crossroad] in Arisan in 1918 [month was not mentioned] and that they seemed to be *V. velutina*. Sonan (1929: 144) listed four workers with the collection data "Arisan (Jûjiro, 5000 ft.) 2–23.X.1918 (Coll. J. Sonan, M. Yoshino)." Sonan did not explicitly refer to a species for the owner of the underground nest, which suggests that these four workers could not be collected from it. If Sonan observed the underground nest in early summer, his observation may suggest the nest-relocation habit of *V. basalis*.

Vespa ducalis Smith 1852 [*Vespa ducalis* Smith 1852]

Sonan (1927: 128) described behavior of a *V. ducalis* female foraging on a *Polistes formosanus* colony nested under the eaves of his house (possibly in Taichung or its vicinity).

Sonan (1929: 138) listed 28 ♀ (21 queens and seven workers) and 1 ♂ from Arisan, Horisha, Kagi, Koshun, Kuraru, Kôtôshô, Musha, Nanto, Raisha, Rengechi, Ryutan, Shinchiku, Taihoku, and Urai. He referred to color variations and conluded that *sorror* would be treated as an aberrant form of *V. ducalis* rather than a variety. He also stated that this hornet was the "archenemmy" of *Polistes* species in Taiwan and was also known to attack honeybee hives. It is well known that *V. ducalis* specializes on hunting independent-founding polistine wasps, such as *Polistes* and *Parapolybia* (Sakagami & Fukushima 1957; Matsuura 1984). Starr (1992), on the other hand, mentioned that *V. ducalis* in Taiwan hunted honey bees in a specialized manner; that is, "*V. ducalis* hovers in front of the entrance [of a bee hive] and dashes at bees in flight." However, there is no observation that *V. ducalis* attacks a bee hive as *V. mandarinia* or *V. soror* does. Sonan's statement of "bee hive attacks of *V. ducalis*" could be based on his treatment of "*soror*" as an aberrant form of *V. ducalis*.

Vespa ducalis ab[erration] *soror* du Buysson 1905 [probably *Vespa mandarinia* Smith 1852]

We failed to locate, in TARI, the following specimens that Sonan (1929) regarded as "ab. *soror*": 1 worker, Sozan, 29.IX.1926 (J. Sonan); 1 queen, Taihoku, 12.VII.1910 (J. Sonan); 1 queen, Taihoku, 23.VII.1927 (K. Shibata); 1 queen, Taihoku, 1.VIII.1927 (K. Shibata); 1 worker, Taihoku, 28.VIII.1927 (J. Sonan); 1 worker, Taihoku, 28.V.1928 (K. Shibata); 1 worker, Taihoku, 10.VII.1925 (J. Sonan). These specimens might belong to *V. mandarinia* as Starr (1992) pointed out.

Vespa magnifica var. *nobilis* Sonan 1929 [*Vespa mandarinia* Smith 1852]

Type material. Sonan (1929: 140) described this nominal taxon with the designation of the queen with the collection data "Musha, 4.VI.1927 (Coll. J. Sonan)" as the HOLOTYPE, which is in TARI and has labels of "Musha / 4-VI-1927 / Col. J. Sonan" and "*Vespa mandarinia* / F. Smith / Det. Starr, 1990". He listed the following specimens designated as PARATYPES (the specimens we have successfully located in TARI are given in brackets with the label data): 1 worker, Arisan, 19.VI.1914 (Coll. M. Maki) [1 queen, "IV 1914 / Arisan / Col. M. Kato"; this specimen might not be a paratype]; 1 queen, Horisha, V–VIII.1918 (Cool. M. Kawamura) [1 worker (queen?), "Formosa / Horisha, -18, / V–VIII. / H. Kawamura"]; 1 worker, Horisha, 20.V.1908 (Coll. I. Nitobe); 2 queens, Musha, 18.V.1919 (T. Okuni, J. Sonan, K. Miyake, M. Yoshino) [1 queen, "Formosa / Musha 1919 / V.18–VI.15 / T. Okuni, J. Sonan, / K. Miy., M. Yosh."]; 2 queens, no locality given, 26.V.1927 (Coll. K. Fukuda) [1 queen, "Musha / 26.V.1927 / Col. K Fukuda"]; 2 queens, Namakaban, 19.IX.1924 (Coll. T. Shiraki, J. Sonan) [1 worker (queen?), "Namakaban / 19.IX.1924 /T. Shiraki / J. Sonan"]; 1 queen, Rakuraku, 11.IX.1924 (Coll. T. Shiraki, J. Sonan) [1 worker (queen?), "Rakurku / 11.IX.1924 / T. Shiraki / J. Sonan"]; 1 worker, Rimogan, 8.XI.1928 (Coll. J. Sonan) [1 worker, "RIMOGAN / 8-XI-1928 / Col. J. Sonan"]; 2 workers, Tompo, 10.IV.1924 (T. Shiraki, J. Sonan) [2 workers, "Tompo / 10.IV.1924 / T. Shiraki / J. Sonan"].

Van der Vecht (1959: 220) treated this nominal taxon as a subspecies of *V. mandarinia*, and Archer (1995) proposed to replace "*nobilis*" as the name of a subspecies of *V. mandarinia* with the informal color form name "Taiwanese". By listing "*Vespa magnifica* Smith var. *nobilis* Sonan, 1929" in the synonym list of *V. mandarinia*, Starr (1992) has synonymized it under *V. mandarinia*; judging from the labels attached to the holotype, C. Starr examined the holotype before the manuscript of his article (Starr 1992) was prepared.

Vespa flavitarsus Sonan 1929 [*Vespa velutina* Lepeletier 1836]

Type material. Sonan (1929) described this nominal taxon with the designation of the queen with collection data "Taiko-san (Kagi), 4–10.II.1924 (Coll. M. Kato)" as the HOLOTYPE. The holotype is in TARI and has labels of "Mt. Taiko, Ka- / gi Gun 3350 ft / Feb. 4–10 -1924 / Col. M. Kato", Type label, "*Vespa* ♀ / *flavitarsus* Sonan /det. J. Sonan", and "160". Sonan (1929: 143) listed the following specimens designated as PARATYPES; we located in TARI those that are marked with asterisks and those for which different number of specimen(s) and/or caste are given in brackets: 1 queen* & 1 worker*, Arisan, 2–23.X.1918 (J. Sonan, M. Yoshino); 1 worker [1 queen*], Arisan, 3.V.1917 (T. Shiraki, J. Sonan); 3 workers*, Arisan, 10.X.1912 (I Nitobe); 3 queens [2 workers*], Funkiko (Arisan, 4600ft.), 16.X.1926 (J. Sonan); 1 worker*, Horisha, V–VIII.1918 (Coll. H. Kawamura); 1 worker*, Kayabara, 4.IX.1923 (T. Shiraki, J. Sonan); 2 queens [2 workers*], Karenko, 20.VII–4.VIII.1919 (T. Okuni, J. Sonan, K. Miyake, M. Yoshino); 2 workers*, Kobayashi (Rato), 29.viii.1923 (T. Shiraki, J. Sonan); 1 worker, Kusukusu, 20.IV.1928 (J. Sonan); 3 workers [1 worker*], Musha, 18.V–15.VI.1919 (T. Okuni, J. Sonan, K. Miyake, M. Yoshino); 1 worker*, Rikiriki, 23.III.1924 (N. Takeda); 1 worker*, Rimogan, 8.XI.1928 (J. Sonan); 1 worker, Raisha, 30.VIII.1927 (J. Sonan, K. Shibata); 1 worker [2 workers*], Shinchiku, 1–30.VIII.1918 (J. Sonan, K. Miyake); 1 worker*, Shinten, 2.VI.1928 (J. Sonan); 1 worker, Shinsuiei, 17.III.1926 (S. Issiki); 1 queen, Taihoku, 30.IV.1919 (I. Nitobe); 1 worker*, Taipin, 12.IX.1910 (T. Shiraki); 2 queens, Takezaki, 15.IX.1926 (J. Sonan); 2 workers* & 1 queen*, Taito, 25.II–25.III.1919 (S. Inamura, J. Sonan, M. Yoshino); 3 workers [1 worker*], Tamaru, 1.IX.1923 (T. Shiraki, J. Sonan); 4 workers*, Tabo, 23.VIII.1923 (T. Shiraki, J. Sonan).

Van der Vecht (1959: 230) treated this nominal taxon as a subspecies of *V. velutina*, and Starr (1992: 106) synonymized it under *V. velutia* by giving "*Vespa flavitarsus* Sonan 1929: 142–143 [holotype worker examined]" in the synonym list of *V. velutina*.

Vespa wilemani Meade-Waldo 1911 [*Vespa vivax* Smith 1870]

Sonan (1929: 147) listed the following four ♀ under *V. wilemani*: 2 ♀, Rantaizan (6000 ft), 20.V.1928 (J. Sonan); ♀, Arisan (4600–7600 ft) 22.IV.1917 (T. Shiraki, S. Sonan); ♀, Karenko (4000–8000 ft), 20.VIII. [probably a typo of VII] – 4.VIII.1919 (T. Okuni, J. Sonan, K. Miyake, M. Yoshino). We located all of them in TARI. Sonan (1929) mentioned that "this species [*V. wilemani*] had been described as a new species by Meade-Waldo based on a single specimen collected by Mr. Wileman in Taiwan; it was not mentioned where Mr. Wileman had collected the wasp, but I think it was probably collected in Rantaizan or Arisan."

Archer (1989: 34) synonymized *V. wilemani* under *V. vivax* in an ambiguous way, by stating "subspecies: *wilemani* Meade Waldo 1911. syn. nov." Later he (Archer 1991, 1994) treated *V. wilemani* as a color form of *V. vivax*. *Vespa vivax* shows a disjunct distribution, occurring in the Hymalayan range (from Kashmir to southern Tibet and northern Myanmar) and mountainious areas in the south-western China (Sichuan, Yunnan) and Taiwan.

Vespa arisana Sonan 1929 [*Vespula arisana* (Sonan 1929)]

Type material. Sonan (1929) described this nominal taxon with the desiganation of the female with collection data "Funkiko (Arisan 4,600 ft.) 16.XI.1926 (Coll. J. Sonan)" as the HOLOTYPE. The holotype is in TARI and labeled "Funkiko / 16.XI.1926 / Col. J. Sonan", Type label, "*Vespa* / *arisana* Sonan / det. J. Sonan", and "167". He listed the following specimens designated as PARATYPES: 2 ♀, Arisan (Funkiko), 2–23.X.1918 (J. Sonan, M. Yoshino); 1 ♀, Horisha, V–VIII.1918 (H. Kawamura); 1 ♀, Taito, 25.II–27.III.1919 (S. Inamura, J. Sonan, M. Yoshino). Of these paratypes, only a single female from "Arisan" and the female from "Horisha" were located in TARI.

Vespa karenkona Sonan 1929 [*Vespula flaviceps* (Smith 1870)]

Type material. Sonan (1929: 148) described this nominal taxon based on 3 ♀ with the collection data "Karenkô (3000–6500 ft.), 20.VII–4.VIII.1919 (Coll. T. Okuni, J. Sonan, K. Yoshino)". Sonan intended to designate the holotype and paratypes, and he mentioned "Type: Body length 14 mm Wing span 23 mm (length of fore wing 10 mm. Paratype: Body length 12–14 mm. Wing span around 23 mm (length of fore wing around 10 mm)" [in Japanese]. In the description of characteristics, he referred to variations in the marking pattern of the clypeus in a rather ambiguous way in terms of the holotype designation. That is, he mentioned that "the clypeus has a dark ferruginous, longitudinal, median line, which does not reach to mid-length of the clypeus" [in Japanese], which would have been the state in the specimen that Sonan intended to designate as the holotype. Then he gave variation in parentheses that "this line varies with individuals, such that the line is medially interrupted to become spots or completely disappeared" [in Japanese]; these two states could have been of the two specimens that Sonan intended to designate as the paratypes. In TARI, there are 3 ♀ with the same collection data and identification labels, "Formosa / Karenko, -19. / VII 20–VIII 4. / T. Okuni, / J. Sonan, / K. Miy., M. Yosh." and "*Vespa* / *karenkona* Sonan / Det. J. Sonan". The female with Type label has the head and left fore wing detached [we glued them on the attached identification label]; its body length was measured about 13 mm, the right fore wing is about 9 mm long, and the clepues has no dark marking. The other 2 ♀ have a Paratype label: their body lengths are about 11 mm and 13 mm, and fore wing lengths are about 9.5 mm and 10.5 mm; the clypeus of the smaller specimen has a dark ferruginous, longitudinal, median band, while that of the larger specimen has only a small dark spot. This observation that only the smaller specimen has the dark median band (or line) on the clypeus suggests that his description of the variations in the marking pattern of the clypeus were not for the paratypes. In conclusion, we have treated the specimen with Type label as the originally designated holotype.

Without examining the holotype of *Vespa karenkona* Sonan, Yamane *et al*. (1980: 16) treated this taxon as a subspecies of *Vespula flaviceps*. Starr (1992: 109), giving "*Vespa karenkona* Sonan 1929: 148 [types examined: holotype worker, 2 paratype workers]" in the synonym list of *Vespula flaviceps*, formally synonymized *Vespa karenkona* under *Vespula flaviceps*.

Vespa 4-maculata Sonan 1929 [*Vespula flaviceps* (Smith, 1870)]

Type material. Sonan (1929) described this nominal taxon based on the single female with the collection data "Arisan, IV.1914 (Coll. M. Maki)". In TARI we located a single female (queen) with the labels of "VI 1914 / Arisan / Col. M. Maki", "5472", "*Vespa* sp. / Det. T. Shiraki", "*Vespa* / *4-maculata* Sonan / Det. J. Sonan", Type label, and "168". Although the month of collection given on the label is different from that mentioned in the original description, this specimen should be the HOLOTYPE of *Vespa quadrimaculata* by monotypy.

Yamane *et al*. (1980), without examining the types of both *V. quadrimaculata* and *V. karenkona*, synonymized the former under the latter. Based on their observation on colony populations of three nests collected at Kwantauchi in Nantou, they concluded that "*quadrimaculata*" was the queen caste and "*karenkona*" was the worker caste of the same species. Starr (1992: 109), giving "*Vespa karenkona* Sonan, 1929: 148–149 [holotype queen examined]" in the synonym list of *Vespula flaviceps*, synonymized *Vespa quadrimaculata* under *Vespula flaviceps*.

Vespa (*Provespa*) *dorylloides* de Saussure 1854 [*Provespa anomala* de Saussure 1854]

Under "*Vespa* (*Prove pa*) [sic!] *dorylloides*", Sonan (1929: 138) recorded a single female with the collection data "Kagi (Taikozan), 27, VI, 1923 (Coll. T. Kato)".

In TARI, there are 4 ♀ and 2 ♂ of *Provespa*; 1 ♂ *Provespa nocturna* van der Vecht and 1 ♀ *P. anomala* (de Saussure) are labeled with "Kotosho / v" and "Vespa / doryloides Sauss / det. T. Shiraki". Remaining specimens (1 ♂ and 3 ♀) have the same identification label "Vespa / dorylloides / Sauss. / Det. J. Sonan"; a *P. nocturna* ♀ and a *P. anomala* ♂ have the same collection data label "NAM HENG / JOHOR – 1917 / S. KIYOTAKE", one of the remaining two *P. anomala* ♀ has no locality label and the other has a label "Mt. Taiko / Kagi / 27 VI 1923 / M. Kato". It seemed that the *P. nocturna* female and the *P. anomala* ♂ labeled as being collected in Johor (in the Peninsular Malaysia) had been correctly labeled. However, considering the facts that Taiwan is far from the distribution area of the two *Provespa* species and no other records of *Provespa* from Taiwan is present, it is hardly acceptable that the specimens labeled as being from "Kagi" and "Kotosho" (if it is Lanyu [= Orchid Island]) had been correctly labeled.

Key to currently valid *Polistes* species occurring in Taiwan

A total of 13 nominal species of the genus *Polistes* are recognized in the Taiwanese fauna. All of them but *P. huisunensis* Kuo, 1987 were recognized by Sonan. As noted above (see *Polistes mandarinus* var. *eboshinus*) and also by Starr (1992), there seem to be a few more *Polistes* species (described and/or undescribed) occurring in Taiwan. The following key is primarily based on that of Starr (1992), and we added characters that would make the key to work only for valid species currently recorded from Taiwan. In other words, those that are not keyed out with this key would be new to Taiwan and/or undescribed species.

1. Pronotal fovea present. Clypeus not or barely produced above the anterior tentorial pit 2
- Pronotal fovea absent. Clypeus dorsally produced far above the anterior tentorial pit. Dorsal mesepisternal groove and epicnemial carina absent. (Subgenus *Polistella* Ashmead) 6
2. Punctures on mesepisternum fine, clathrate. Pronotal carina shortened, not lamellate below fovea. Prestigma of fore wing short, less than 0.5 × length of pterostigma (measured along ventral part), with straight tip. Dorsal mesepisternal groove and epicnemial carina present. Male clypeus weakly and broadly rounded apically, flattened medioventrally, with low ridges on both lateral margins of median flat area . . . . . *P.* (*Polistes*) *chinensis* (Fabricius)
- Punctures on mesepisternun coarse, larger than their interstices. Pronotal carina lamellate ventrad to fovea. Prestigma of fore wing distinctly more than half as long as length of pterostigma, with slightly recurved tip. (Subgenus *Gyrostoma* Kirby) . . . 3
3. Either dorsal mesepisternal groove or epicnemial carina absent. Body more or less uniformly reddish brown to dark brown, without yellow markings 4
- Dorsal mesepisternal groove and epicnemial carina both present. Ground color of body black with abundant yellow markings. Male terminal sternum with paired apical apophyses 5
4. Dorsal mesepisternal groove present; epicnemial carina absent. Gena not extremely developed; in profile of head, posterior margin of gena more or less smoothly and evenly curved, female gena about 1.3 times and male gena about 1.1 times as wide as eye. Malar space not very long, in female about 0.3 as long as antennal scape. Not extraordinarily large species; body length

(head + mesosoma + first two metasomal segments) usually less than 21 mm, fore wing length less than 22 mm . . . . . *P.* (*Gyrostoma*) *tenebricosus* Lepeletier

- Dorsal mesepisternal groove absent, epicnemial carina present. Gena extremely developed, especially in male; in profile of head, female gena distinctly swollen posteriorly near level of eye top and about 1.4 times as wide as eye, and male gena about 3.5 times as wide as eye. Malar space long, in female about 0.4 of length of antennal scape. Extraordinarily large species; body length (head + mesosoma + first two metasomal segments) usually more than 23 mm, fore wing length more than 26 mm . . . . . *P.* (*Gyrostoma*) *gigas* (Kirby)

5. Anterolateral corner of propodeum hardly produced laterally. Female occipital carina evanescent ventrally, not reaching base of mandible. Male clypeus touching eyes. Male terminal antennal flagellomere slightly curved, not flattened. Male terminal sternal apophyses short and broad (see Starr, 1992: fig. 39a). . . . . *P.* (*Gyrostoma*) *jokahamae* Radoszkowski

- Anterolateral corner of propodeum rather strongly angled, produced laterally. Female occipital carina complete, reaching base of mandible. Male terminal antennal flagellomere spatulate. Male terminal sternal apophyses long and narrow (see Starr, 1992: fig. 39b). . . . . *P.* (*Gyrostoma*) *rothneyi* Cameron

6. Second metasomal sternum evenly and weakly rounded, in lateral view gradually and weakly swollen toward its posterior margin, with ventral margin evenly and weakly curved (Fig. 1) 7

- Second metasomal sternum more or less truncate basally, in lateral view ventral margin strongly swollen ventrally in anterior part, then becoming more or less parallel to ventral margin of second tergum (Figs. 2–5) 10

7. Pronotum with strong transverse striae, without distinct punctures; dorsal and lateral face separated by distinct angle running back toward tegula. Body almost entirely reddish brown. . . . . *P.* (*Polistella*) *strigosus* Bequaert

- Pronotum covered with dense punctures, without distinct striae; dorsal surface smoothly curved down to lateral surface. Body more bright colored, with yellow markings 8

8. Small species, body length (head + mesosoma + first two metasomal segments) less than 11 mm, fore wing length less than 12 mm. Fore wing with distinct dark spot anterodistally, occuying distal two-thirds of marginal cell and anterior parts of second and third submarginal cells. First metasomal tergum in lateral view not thick, lower than long; anterior truncation behind basal slit for reception of propodeal suspensory ligament indistinct . . . . . *P.* (*Polistella*) *stigma* (Fabricius)

- Medium-sized species, body length (head + mesosoma + first two metasomal segments) more than 13 mm, fore wing length more than 14 mm. Fore wing without distinct dark spot. First metasomal tergum in lateral view thick, about as high as long; anterior truncation behind basal slit for reception of propodeal suspensory ligament distinct (Fig. 1) 9

9. Female clypeus just below tentorial pits barely swollen anteriorly, with lateral margins in frontal view weakly convex (see Saito *et al.* 2007: fig. 2A,B), thus in lateral view passing into supraclypeal area smoothly or with very slight convexity (see Saito *et al.* 2007: fig. 2H). Male clypeus with suture for dorsolateral margin barely visible. Male terminal flagellomere proportionally shorter, about 2.8 times as long as its basal width (see Saito *et al.* 2007: fig. 2I). Furrow between metanotum and propodeum deep (see Saito *et al.* 2007: fig. 2K) . . . . . *P.* (*Polistella*) *formosanus* Sonan

- Female clypeus just below tentorial pits weakly swollen anteriorly, with lateral margins in frontal view convex (see Saito *et al.* 2007: fig. 2A,B), thus in lateral view with more or less distinct convexity in supraclypeal area. Male clypeus with suture for dorsolateral margin visible. Male terminal flagellomere proportionally longer, about 3.4 times as long as its basal width (see Saito *et al.* 2007: fig. 2J). Furrow between metanotum and propodeum shakkow (see Saito *et al.* 2007: fig. 2L) *P.* (*Polistella*) *japonicus* de Saussure

10. Female clypeus slightly higher (distance from bottom of dorsal emargination to apex) than wide (distance between upper points where clypeus touches eyes) (Fig. 6). Female (often male) frons, vertex and mesoscutum substantially red- to reddish-brown-marked. Female mandible yellow. Second metasomal sternum in lateral view with ventral margin broadly rounded in anterior one-third to half of the segment (Fig. 2). Female clypeus yellow. Propodeum with paired wide yellow bands. . . . . *P.* (*Polistella*) *shirakii* Sonan

- Female clypeus slightly wider than or as wide as high (Figs 7–9). Frons, vertex and mesoscutum entirely black. Female mandible orange to reddish brown 11

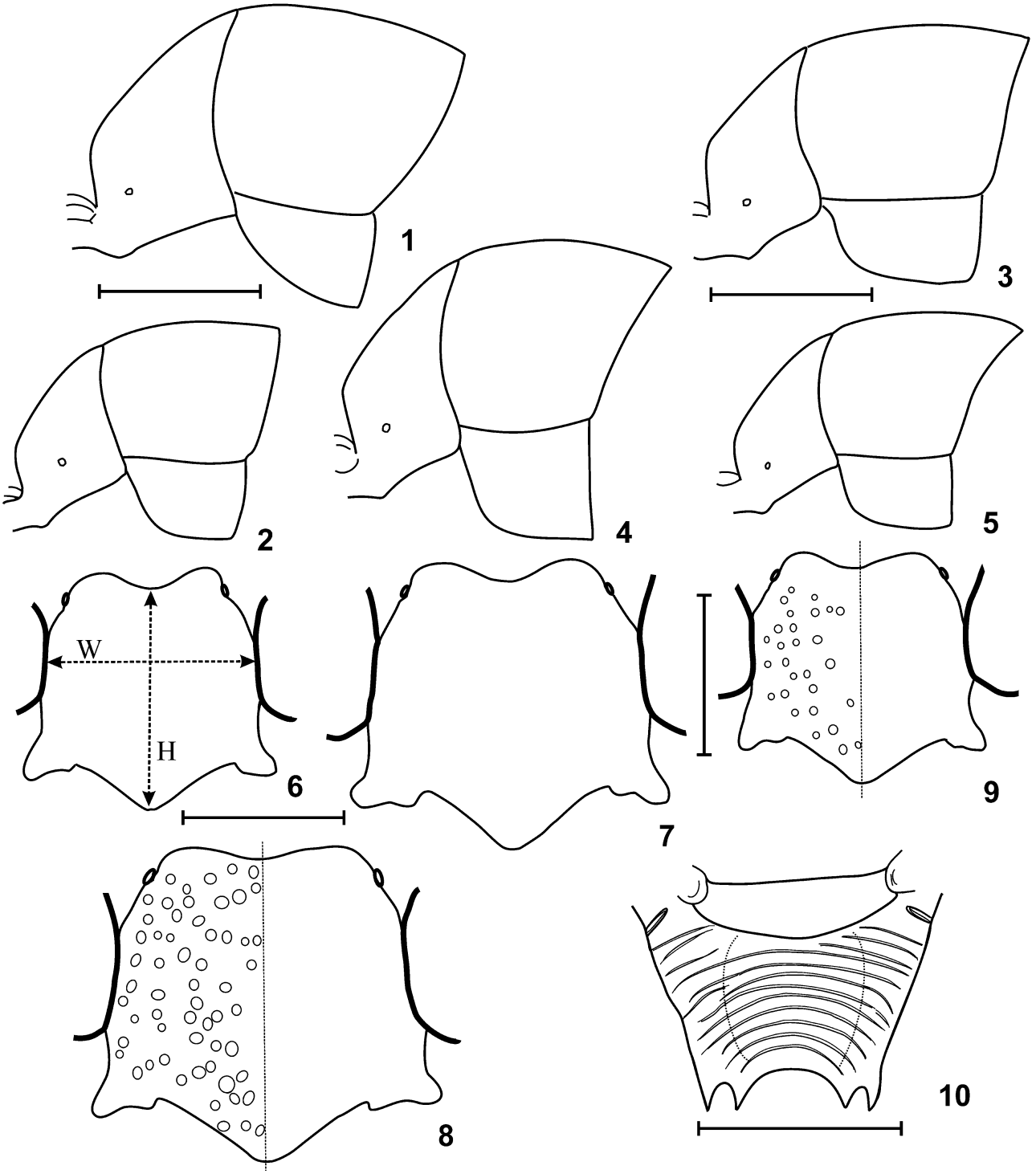
11. Propodeum with paired wide yellow bands. Pronotum behind pronotal carina red with narrow yelow borders in front and behind. Female clypeus yellow to yellowish orange, with narrow dark band on each side. Second metasomal sternum in lateral view strongly swollen ventrally in anterior one-fifth to one-fourth of the segment (Fig. 3) . . *P.* (*Polistella*) *takasagonus* Sonan

- Propodeum except valvulae entirely black or with at most paired very short, slight yellow stripes. Pronotum behind pronotal carina not yellow marked. Female clypeus reddish brown 12

12. Medium-sized, robust wasp; fore wing length 10–14 mm. Metanotum in lateral view at its front edge projecting up, not in continuous line with scutellum. Median excavation of propodeum shallow, but more or less defined laterally, wide, anteriorly wider than or as wide as posterior width of disk of metanotum. First metasomal tergum robust (Fig. 4), slightly longer (distance in lateral view from posterior margin of basal slit for reception of propodeal suspensory ligament to the posterodosal end) than high (in lateral view hight at the posterior margin), about 1.2 times as wide (maximum width in dorsal view) as long; in lateral view basal truncation distinct. Second metasomal sternum in lateral view strongly swollen ventrally in anterior one-third of the segment, then ventral margin angulate (Fig. 4). Male terminal flagellomere very long, about 3 times as long as its basal width (see Starr 1992: fig. 40j). Female gena mainly red, with continuous red band next to eye. Female cypeus relatively densely punctured (Fig. 8), covered with short appressed tomentum in dorsal third to half. Male clypeus about as long as wide . . . . . *P.* (*Polistella*) *huisunensis* Kuo

- Small, medium-robust wasp; fore wing length 8–10 mm. Metanotum in lateral view at its front edge in continuous line with scutellum. Median excavation of propodeum shallow, ill-defined laterally, narrow, narrower than posterior width of disk of metanotum (Fig. 10). First metasomal tergum not so robust (Fig. 5), about 1.1 times longer than high, about 1.1 times as wide as long; in lateral view basal truncation not so distinct. Second metasomal sternum in lateral view swollen ventrally in about

anterior one-third of the segment, then ventral margin rounded (Fig. 5). Male terminal flagellomere shorter, less than 2 times as long as its basal width (see Starr 1992: fig. 40i). Female gena mainly red only in lower one-third to half, without continuous red band. Female cypeus relatively sparsely punctured (Fig. 9), covered with appressed tomentum in dorsal half. Male clypeus about as long as wide. Second to sixth metasomal terga finely, indistinctly punctured . . . . . *P.* (*Polistella*) *eboshinus* Sonan



FIGURES 1–10. Characters of Taiwanese *Polistes* species, ♀. 1. *P. formosanus*. 2, 6. *P. shirakii*. 3, 7. *P. takasagonus*. 4, 8. *P. huisunensis*. 5, 9–10. *P. eboshinus*. 1–5. First and second metasomal segments, lateral view. 6–9. Clypeus. 6. Indicating width (w) and height (h) of clypeus measured. 8–9. Showing punctures on right half. 10. Metanotum and propodeum, posterolateral view. Scale 2 mm for 1–5, 10; 1 mm for 6–9.

Notes on the types of the nominal species-group taxa described by J. Sonan from Japan and deposited in TARI

Polistes yamanakai Sonan 1937 (= *Polistes nipponensis* Pérez 1905)

Compared with *Polistes mandarinus* de Saussure 1853 from China, Sonan (1937) described *Polistes yamanakai* based on the holotype ♀ from Tokyo, and a paratype ♂ (from Atami) and 7 paratype ♀ (from Tokyo, Atami, Ise, Yamanashi, Oita [Obira], and Nagasaki). All of these types are in TARI.

Type material. The HOLOTYPE, of which the head is detached and glued on a card, is lacking both antennae leaving only the scapes intact; it is labelled "Tokyo / 2-VII-1931 / M. Nakamura", "*Polistes* / *mandarinus* ♀ / Sauss / det. M. Yamanaka", "*Polistes* / *yamanakai* / Sonan", the circular type label, and "150". The PARATYPE ♂ has a label of collection data "10 [unreadable] 908 / Atami"). Each of six of the seven paratype females have respectively a collection data label as "VIII Tokyo / T. Shiraki", "ISE / 1928 / J. YAMANOUCHI", "Nishigahara / TOKYO / 24 V 1932 / Y. Nakamura", "Yamanashi / VII 1929 / C. Masuda", "Obira / Kyushu / 5-VIII-1932 / T. Shiraki", and "Nagasaki / 31 V 1913 / Y. Horikawa". One ♀ with Sonan's identification label and paratype label and "150" could correspond to the paratype ♀ mentioned by Sonan as "♀, Atami, Aug. 10 1908, T. Shiraki".

All of these types belong to *Polistes nipponensis* Pérez, 1905 and the synonymy of *Polistes yamanakai* Sonan, 1937 under *Polistes nipponensis* Pérez, 1905 has been confirmed.

Vespa matsumurai Sonan 1935 (= *Vespa ducalis* Smith 1852)

Type material. Sonan (1935b), having compared with *Vespa ducalis* var. *pulchra*, described this nominal taxon from Tokyo, Japan. He gave the same collection data "♀, Tokyo, Oct. 13 1932 (Y. Nakamura)" for the holotype and the paratype. In TARI, there are the following three female specimens: 1 ♀ labeled "Nishigahara / Tokyo /13 X. 1932 / Y. Nakamura", Type label, "Vespa / matsumurai / Sonan / DET. J. SONAN", and "164"; 1 ♀ labeled "Nishigahara / Tokyo /13 X. 1932 / Y. Nakamura", Paratype label, "Vespa / matsumurai / Sonan / DET. J. SONAN", and "165"; and 1 ♀ labeled "ISE / 1928 / J. YAMANOUCHI", "Vespa / matsumurai / Sonan / DET. J. SONAN", Paratype label, and "166". As Sonan (1935b) did not mention the specimen from Ise, the specimen does not have any type status.

Acknowledgements

We thank Chi-Feung Lee and Jung-Tai Chao for arranging our research in TARI. Our thanks also go to Jung-Tai Chao for his comments on the locality names given in the Appendix. This research was supported by grants from the Japan Society for the Promotion of Science to JK and LTPN (No. 20•08416) and to FS (No. 20•3623). We thank Christopher K. Starr (University of the West Indies, St. Augustine, Trinidad & Tobago) and an anonymous reviewer for their valuable comments and suggestions.

References

Archer, M.E. (1989) A key to the world species of the Vespinae (Hymenoptera). *Research Monograph of the College of Ripon and York St. John*, 2(1), 1–41.

Archer, M.E. (1991) The number of species that can be recognised within the genus *Vespa* (Hym., Vespinae). *Entomologist's Monthly Magazine*, 127, 161–164.

Archer, M.E. (1995) Taxonomy, distribution and nesting biology of the *Vespa mandarinia* group (Hym., Vespinae). *Entomologist's Monthly Magazine*, 131, 47–164.

Bequaert, J. (1918) A revision of the Vespidae of the Belgian Congo based on the collection of the American Museum Congo expedition, with a list of Ethiopian diplopterous wasps. *Bulletin of the American Museum of Natural History*, 39, 1–384.

Bequaert, J. (1936) The common Oriental hornets, *Vespa tropica* and *Vespa affinis*. *Treubia*, 15, 329–351.

Bequaert, J. (1939) The Oriental *Vespa analis* Fabricius and its color forms, with a note on the synonymy of *Vespa esakii* Sonan and *Vespa formosana* Sonan. *Transactions of the American Entomological Society*, 65, 37–42.

Bequaert, J. (1940) Notes on Oriental *Polistes* wasps (Hymenoptera: Vespidae). *Transactions of the American Entomological Society*, 66, 265–272.
Bingham, C.T. (1897) *The Fauna of British India, including Ceylon and Burma. Hymenoptera. Vol. I. Wasps and Bees*. Taylor and Francis, London. xxix + 579 pp. + 4 pls.
Buysson, R. du (1903) Note pour servir à l'histoire des Strepsiptéres. *Bulletin de la Société entomologique de France*, 1903, 174–175.
Buysson, R. du (1905) ["1904"] Monographie des guêpes ou *Vespa*. *Annales de la Société entomologique de France*, 73, 485–556, 565–634.
Buysson, R. du (1913) Sur quelques Vespides (Hym.). *Bulletin de la Société entomologique de France*, 1913, 296–299.
Cameron, P. (1900) Descriptions of new genera and species of Hymenoptera. A. New species of Vespidae from India and Japan. *Annals and Magazine of Natural History (7)* 6, 410–419, 495–506, 530–537.
Dalla Torre, K.W. von (1894) *Catalogus Hymenopterorum hucusque Descriptorum Systematicus et Synonymicus. Volumen 9, Vespidae* (*Diploptera*), Guilelmi Engelmann, Lipsiae, iv + 181 pp.
Dalla Torre, K.W. von (1904) Fam. Vespidae. *In*: Wytsman, P., *Genera Insectrum*, Fasc. 19, Bruxelles, 108 pp. + 6 pls.
De Geer, C. (1773) *Mémoires pour Servir à l'Histoire des Insectes. Tome troisiéme.* P. Hesselberg, viii + 696 pp. + 44 pls.
Fabricius, J.C.F. (1775) *Systema Entomologiae, Sistens Insectorum Classes, Ordines, Genera, Species adiectis Synonymis, Locis, Descriptionibus, Observationibus*, Kortii, Flensburgi et Lipsiae, [32] + 832 pp.
Fabricius, J.C.F. (1787) *Mantissa Insectorum Sistens Eorum Species Nuper Detectas Adiectis Characteribus Genericis, Differentiis Specificis, Emendationibus, Observationibus, Vol. 1*. Christ. Gottl. Proft, Hafniae, xx + 348 pp.
Fabricius, J.C.F. (1793) *Entomologia Systematica Emendata et Aucta. Secundum Classes, Ordines, Genera, Species Adjectis Synonimis, Locis, Observationibus, Descriptionibus, Vol. 2.* Christ. Gottl. Proft, Hafniae, viii + 519 pp.
Fabricius, J.C.F. (1804) *Systema Piezatorum Secundum Ordines, Genera, Species Adiectis Synonymis, Locis, Observationibus, Descriptionibus*. Carolum Reichard, Brunsvigae, xiv + 440 + 30 pp.
Horne, C. & Smith, F. (1870) Notes on the habits of some hymenopterous insects from the North-west Province of India, with an appendix, containing descriptions of some new species of Apidae and Vespidae collected by Mr. Horne. *Transactions of the Zoological Society of London*, 7(3), 161–196, pls. 19–22.
International Commission on Zoological Nomenclature (1999) *International Code of Zoological Nomenclature, Fourth Edition*. ITZN, London, xxx + 306 pp.
Japanese Society of Applied Entomology and Zoology (1984) Obituary. *Japanese Journal of Applied Entomology and Zoology*, 28, 187. (In Japanese).
Kirby, W. & Spence, W. (1826) *An Introduction to Entomology, or Elements of the Natural History of Insects, First edition*, 3. viii + 732 pp. + 15 pls.
Kojima, J. & Hagiwara, Y. (1998) Lectotype designation of four species and one form of the paper wasp genus *Polistes* Latreille, 1802 described from Japan, with notes on the scientific names of Japanese *Polistes* (Hymenoptera: Vepidae; Polistinae). *Natural History Bulletin of Ibaraki University*, (2), 247–262.
Kuo, M.-C. (1984) A study of the ecology of *Vespa formosana* Sonan (Studies of Vespidae in Taiwan, Part I). *Journal of National Chiayi Institute of Agriculture*, 10, 73–92. (In Chinese).
Kuo, M.-C. & Yeh, W.-H. (1985) Ecological studies on *Vespa basalis* Smith, *Vespa velutina flavitarsis* Sonan and *Vespa tropica pseudosoror* Vecht (Study on Vespidae in Taiwan II). *Journal of National Chiayi Institute of Agriculture*, 11, 95–106. (In Chinese with English summary).
Kuo, M.-C. & Yeh, W.-H. (1987) Ecological studies on *Vespa*, *Polistes*, *Parapolybia* and *Ropalidia* (Study on Vespidae in Taiwan III). *Journal of National Chiayi Institute of Agriculture*, 16, 77–104. (In Chinese with English summary).
Kuroiwa, H. (1908) Provisional List of the Hymenoptera Collected in Loochoo Determined by Dr. S. Matsumura. *Kunchan-Nogakko, Ryukyu*, 1908, 1–7.
Kuroiwa, H. (1926) Provisional list of the Hymenoptera collected in Loochoo Islands during the years 1905–1907. *Transactions of the Natural History Society of Formosa*, 16, 138–141.
Lepeletier de Saint Fargeau, A.L.M. (1836) *Histoire Naturelle des Insectes. Hyménoptères. Tome premier.* Librairie Encyclopédique de Roret, Paris, 547 pp.
Linnaeus, C. (1758) *Systema Naturae. Tomus 1. Editio decima, reformata*. Laurentii Salvii, Holmiae, iv + 824 pp.
Linnaeus, C. (1764) *Museum S:ae R:ae M:tis Ludovicae Ulricae Reginae*. L. Salvii, Holmiae, vi + 720 pp.
Matsumura, S. (1908) *Nihon Ekichû Mokuroku* [List of Japanese Beneficial Insects]. Rokumeikan, Tokyo, 174 pp. (In Japanese).
Matsumura, S. (1910) *Die Schädlichen und Nützlichen Insekten vom Zuckerrohr Formosas*. Keiseisha, Tokyo, 52 pp. + 30 pls.
Matsumura, S. (1911) *Thousand Insects of Japan, Supplement 3*. Keiseisha-shoten, Tokyo, 147 pp. + pls. 30–41. (In Japanese).
Matsumura, S. & Uchida, T. (1926) Die Hymenopteren-Fauna von den Riukiu-Inseln. *Insecta Matsumurana*, 1, 32–52.
Matsuura, M. (1984) Comparative biology of the five Japanese species of the genus *Vespa* (Hymenoptera, Vespidae). *Bulletin of the Faculty of Agriculture, Mie University*, (69), 1–131.
Meade-Waldo, G. (1911) New species of Diploptera in the collection of the British Museum. Part III. *Annals and Magazine of Natural History (8)* 7, 98–113.
Pérez, J. (1905) Hyménoptères recueillis dans le Japon central par M. Harmand, Ministre Plénipotentiaire de France à Tokio. *Bulletin du Muséum National d'Histoire Naturelle, Paris* 1905, 23–41, 79–87, 148–158.
Radoszkowski, O. (1887) Hyménoptères de Korée. *Horae Societatis Entomologicae Rossicae*, 21, 428–436.
Saito, F., Kojima, J., Nguyen, L.T.P. & Kanuka, K. (2007) *Polistes formosanus* Sonan, 1927 (Hymenoptera: Vespidae), a good

species supported by both morphological and molecular phylogenetic analyses, and a key social wasp in understanding the historial biogeography of the Nansei Islands. *Zoological Science*, 24, 927–939.
Saito, F., Kojima, J., Ubaidillah, R. & Hartini, S. (2005) Paper wasps of the genus *Polistes* in Eastern Lesser Sunda Islands (Hymenoptera: Vespidae). *Journal of Hymenoptera Research*, 14, 102–114.
Sakagami, S.F. & Fukushima, K. (1957) Some biological observations on a hornet, *Vespa tropica* var. *pulchra* (du Buysson), with special reference to its dependence on *Polistes* wasps (Hymenoptera). *Treubia*, 24, 73–82.
Saussure, H. de (1853–1858) *Études sur la Famille des Véspides. 2. Monographie des Guêpes Sociales, ou de la Tribu des Vespiens, ouvrage faisant suite à la Monographies des Guêpes Solitaires*. V. Masson, Paris & J. Kessmann, Genéve, i–cxliv + 1–256 pp. + 37 pls. (1853) 1–96 + pls. 2–8, 13;, (1854) 97–256 + pls. 9–12, 14–18, 20–24, 27–33; (1855) pl. 1; (1857) i–xlviii + pls. 35–37; (1858) xlix–cxliv + pls. 19bis, 30 bis. (Date of publication after Griffin 1939).
Saussure, H. de (1858) Note sur la famille des Vespides. *Revue et Magasin de Zoologie Pure et Appliquée (2)* 10, 63–66, 162–171, 259–261.
Smith, F. (1852a) Descriptions of some new and apparently undescribed species of Hymenopterous insects from North China, collected by Robert Fortune, Esq. *Transactions of the Entomological Society of London* (*new series*), 2, 33–45, pl. VIII.
Smith, F. (1852b) Descriptions of some Hymenopterous insects from northen India. *Transactions of the Entomological Society of London* (*new series*), 2, 45–48, pl. VIII.
Smith, F. (1852c) Descriptions of some hymenopterous insects captured in India, with notes on their economy, by Ezra T. Downes, Esq., who presented them to the Honourable the East India Company. *Annals and Magazine of Natural History* (*2*), 9, 44–50.
Smith, F. (1857) *Catalogue of Hymenopterous Insects in the Collection of the British Museum. Part V. Vespidae.* British Museum, Department of Zoology, London. 147 pp.
Smith, F. (1868) Description of an undescribed species of wasp and its nest, received from Hakodadi, in Japan. *Entomologist's Monthly Magazine*, 4, 279–280.
Sonan, J. (1927) Taiwan-san hachirui su-shu no gakumei oyobi kansatsu [only in Japanese, without English title. Translation to English: On scientific names and observations on biology of some hymenopteran insects in Taiwan; Starr (1992) gave the English translation of the title of this article as "Taxonomic notes and observations on Hymenoptera of Taiwan"]. *Transactions of the Natural History Society of Formosa*, 17, 121–138, pls. 1 & 2. (In Japanese).
Sonan, J. (1929) On *Vespa* from Formosa (1). *Transactions of the Natural History Society of Formosa*, 19, 136–149, pl. 6. (In Japanese).
Sonan, J. (1931) Some wasps and bees of Hôkotô (Pescadores) (2). *Transactions of the Natural History Society of Formosa*, 21, 6–8. (In Japanese).
Sonan, J. (1935a) On the genus *Ropalidia* from Formosa and Okinawa (Hymenoptera, Vespidae). *Transactions of the Natural History Society of Formosa*, 25, 199–202.
Sonan, J. (1935b) Descriptions of two new species of the family Vespidae. *Transactions of the Natural History Society of Formosa*, 25, 370–372.
Sonan, J. (1937) Two new species and one new genus of Hymenoptera. *Transactions of the Natural History Society of Formosa*, 27, 169–174.
Sonan, J. (1938) H. Sauter's Formosa-collection: *Polistes*, *Montezumia* and *Pareumenes*. *Arbeiten über Morphologische und Taxonomische Entomologie*, 5, 66–70.
Sonan, J. (1943) Taiwan-san ashinagabachi-zoku *Polistes* Latreille ni tsuite [no English title; translation to English: On the genus *Polistes* Latreille from Taiwan]. *Transactions of the Natural History Society of Formosa*, 33, 467–484. (In Japanese).
Sonan, J. (1944) On *Parapolybia* Saussure in Taiwan. *Transactions of the Natural History Society of Formosa*, 34, 342–345. (In Japanese).
Starr, C.K. (1992) The social wasps (Hymenoptera: Vespidae) of Taiwan. *Bulletin of the National Museum of Natural Science*, (3), 93–138.
Sung, I.-H., Yamane, Sk., Yamane, Sô. & Ho, K.-K. (2006) A new record of a hornet (Hymenoptera: Vespidae) from Taiwan. *Formosan Entomology*, 26, 303–306.
Vecht, J. van der (1941) The Indo-Australian species of the genus *Ropalidia* (=*Icaria*) (Hym., Vespidae) (First part). *Treubia*, 18, 103–190.
Vecht, J. van der (1957) The Vespinae of the Indo-Malayan and Papuan areas (Hymenoptera, Vespidae). *Zoologische Verhandelingen*, 34, 1–83.
Vecht, J. van der (1959) Notes on Oriental Vespidae, including some species from China and Japan (Hymenoptera, Vespidae). *Zoologische Mededelingen*, 36, 205–232.
Vecht, J. van der (1966) The East Asiatic and Indo-Australian species of *Polybioides* Buysson and *Parapolybia* Saussure (Hymenoptera: Vespidae). *Zoologische Verhandelingen*, 82, 1–42.
Yamane, Sk., Wagner, R.E. & Yamane, Sô. (1980) A tentative revision of the subgenus *Paravespula* of Eastern Asia (Hymenoptera: Vespidae). *Insecta Matsumurana* (*new series*), 19, 1–46.
Yamane, Sk., Yamane, Sô. & Wang, H.-Y. (1995) The identity of *Parapolybia takasogona* Sonan (Hymenoptera, Vespidae). *Proceedings of the Japanese Society of Systematic Zoology*, (54), 75–78.
Yano, M. (1932) Vespidae. *In*: Uchida, S. *et al*. (Eds.), *Nippon Konchu Zukan* (*Iconographia Insectorum Japonicorum*), *1st Edition*. Hokuryukan, Tokyo, pp. 296–305.

APPENDIX. Locality names in Sonan's articles on Taiwanese social wasps.

In most of Sonan's articles treating Taiwanese social wasps, not only descriptions of characters but also locality names were given in Japanese. Even when locality names were given in alphabets, they were expressed in the way of Japanese reading; this is also the case for locality data given on the labels attached to the specimens that Sonan examined. Herewith we list as many as possible locality names used by Sonan in his articles on social wasps together with their corresponding currently used names and approximate coordinates and altitudes (if available).

The present list together with the locality names given in Chinese characters and /or Japanese letters (Katakana) is available http://www.ipc.ibaraki.ac.jp/~jkrte/wasp/loc_sonan.html.

In the compiling of list we have used the GoogleEarth and web-sites http://worldpostmarks.com/HTML%20Countries/japan.htm and http://www.bl.mmtr.or.jp/~idu230/tabun/kukaku/kumokuji.htm, as well as "A Preliminary Study of Japanese Police Chuzaisyo (substation at aboriginal area) in Colonial Taiwan" (National Taiwan Museum, Yi-Hung Lin, 2010) is worth being referred to.

Ako: Ahou, old name of Pingtung City; 22°41' N, 120°30' E.
Arisan: Alishan; 23°32' N, 120°48' E.
Bakulas [or Bakuras]: Bakulasi, in Ren-ai Township, Nantou County; 23°49' N, 121°00' E, alt. 545 m.
Baron in Shinchiku Province: Zhongbaling, in Fusing Township, Taoyuan County; 24°48' N, 121°22' E, alt. 1,240 m.
Batoran (Karenko): in Sioulin Township, Hualien County; 23°59' N, 121°28.5' E, alt. 195 m.
Bokoto: see Hokoto.
Bukai in Taichu Province: Wujie, in Ren-ai Township, Nantou County; 23°53' N, 121°02' E, alt. 725 m.
Bunzan-gun: Administrative section during the Japanese occupation time, including current Sindian City, Wunshan in Taipei City, Shenkeng Township, Shihding Township, Pinglin Township, and Wulai Township.
Chikuto [or Chikutou]: Jhudong, Hsinchu County; 24°44' N, 121°05' E, alt. 95 m.
Chipon: Zhiben, in Beinan Township, Taitung County; 22°42.5' N, 121°03.5' E, alt. 125 m.
Choshu: Chaozhou, Pintung County; 22°33' N, 120°32' E, alt. 30 m.
Daimokko: Hsinhua District, Tainan City; 23°02' N, 120°20' E, alt. 35 m.
Dakusui (Ratô): Donglei, in Datong Township, Yilan County; 24°33' N, 121°33.5' E, alt. 240 m.
Doba (foot of Taiheizan): Tuchang, in Datong Township , Yilan County; 24°34.5' N, 121°30' E, alt. 500 m.
Dômon: Tongmen, in Xiulin (Sioulin) Twonship , Hualien County; 23°58' N, 121°29.5' E, alt. 155 m.
Eboshi (foot of Taiheizan): Dulishan, in Datong Township, Yilan County; 24°34' N, 121°30' E, alt. 350 m.
Fuka [or Fuko]: Hongkang, in Sinhzin Township, Pintung County; 22°11' N, 120°41' E, alt. 20 m.
Funkiko: Fenchihu, at altitude of about 1,400 m in Alishan; 23°30.5' N, 120°41.5' E
Garanbi): Eluanbi, in Hengchun Township, Pintung County; 1°55' N, 120°50.5' E, alt. 70 m.
Giran: Yilan, Yilan County; 24°46' N, 121°45' E, alt. 25 m.
Gokenseki: see also Kobi; Wuchientso [= Huwei], Yunlin County; 23°43' N, 120°26' E, alt. 25 m.
Hassen-Zan [or Hassen-san]: Basianshan, in Heping District, Taichung City; 24°09' N, 121°00.5' E, alt. 1,950 m.
Heichin: Pingzhen, Taoyuan County; 24°56' N, 121°12' E, alt. 155 m.
Heitou: Pintung, Pintung County; 22°39' N, 120°28' E, alt. 25 m.
Hokoto [or Bokoto or Hookoto]: Penghu Dao; 23°34' N 119°34' E.
Hokuto: Peitou in Taipei City; 25°08' N, 121°30' E, alt. 35 m.
Hori [or Horisha]: Puli, Nantou County; 23°58' N, 120°58' E, alt. 500 m.
Jukirin (Shinchiku): Cyonglin, Cyonglin Township, Hsinchu County; 24°47' N, 121°04' E, alt. 100 m.
Kagi: Chiayi, Chiayi County; 23°28.5' N, 120°26.5' E, alt. 40 m.
Kankau: Kankau [or Kankao], in Manjhou Township, Pintung County; 21°58.5' N, 120°49.5' E, alt. 270 m.
Kanko: Kuankao, in Hsinyi Township, Nantou County; 23°29' N, 120°58' E, alt. 2,515 m.
Kanshirei: Guanziling [Guanzailing], in Baihe Township, Tainan County; 23°20.5' N, 120°28.5' E, alt. 330 m.
Kappan-san: Chiaopanshan, in Fusing Township , Taoyuan County; 24°49' N, 121°21' E, alt. 435 m.
Karenkou [or Karenko or Karenkô]: Hualien, Hualien County; 23°58' N, 121°36' E, alt. 60 m.
Kayahara [or Kayabara]: Hsuanyuan, in Fusing Township, Taoyuan County; 24°48' N, 121°21' E, alt. 810 m.
Keibe: Possibly misprint of "Keibi" .
Keibi: Jingmei, in Taipei City; 24°59' N, 121°32' E, alt. 20 m.
Kiraikei: Chi-lai-his, in Sioulin Township , Hualien County; 24°01' N, 121°18' E, alt. 1,800 m.
Kobayashi (Rato): "Rato: Kobayash" appears not rarely in taxonomic or natural history articles on Taiwan fauna and flora published in the period of Japanese occupation. This seems to be one of the places where Japanese police stations "Chuzaisho" were situated; according to Lin (2010), the place has no modern name and is in Datong Township , Yilan County , at 24°39' N, 121°30.5' E, and 670 m alt.
Kobi: Huwei, Yunlin County; 23°43' E, 120°26' N, alt. 25 m.
Kosempo: Jiasianpu, in Jiasian Township, Kaohsiung County; 23°04' N, 120°35' E, alt. 290 m.
Koshun [or Koushun]: Hengchun, Pintung County; 22°00' N, 120°45' E, alt. 40 m.
Kotosho [or Kôtôshô]: Lanyu [Botel-Tobago; Orchid Island]; 22°03' N, 121°33' E, max.alt. 420 m.

Kouzan [or Kôzan]: Siangshan, Hsinchu City; 24°47' N, 120°55.5' E, alt. 20 m.
Kuraru: in Sheding Nature Park, Kenting National Park, Pintung County; 21°57.5' N, 120°49' E, alt. 100 m.
Kurau: Possibly misprint of “Kuraru”.
Kusukusu: Kaoshihfu, in Mudan Township, Pintung County; 22°08' N, 120°48' E, alt. 340 m.
Makazayazaya (in Heito-gun): Majia, in Majia Township, Pintung County; 22°42.5' N 120°39' E, alt. 725 m.
Maruyama: Yuanshan, in Shihlin District, Taipei City; 25°04.5' N 121°31.5' E, alt. 20 m.
Matanguru: Matian, in Haiduan Township, Taitung County; 23°11.5' N, 121°01.5' E, alt. 1,550 m.
Mizuho (Karenko): Ruisui, in Ruisui Township, Hualien County; 23°30' N, 121°22.5' E, alt. 100 m.
Musha: Wushe, in Ren-ai Township , Nantou County; 24°01' N, 121°07' E, alt. 1,150 m.
Naifunbo: Neimaobu, in Hsinyi Township, Nantou County; 24°07' N, 120°48' E, alt. 290 m.
Namakaban (Niitaka-yama): Luona, in Hsinyi Township, Nantou County; 23°41' N, 120°51' E, alt. 985 m.
Nanto: Nantou City, Nantou County; 23°55' N, 120°41' E, alt. 160 m.
Naro: Nalou, in Jianshi Township, Hsinchu County; 24°41' N, 121°15' E, alt. 575 m.
Niitaka-yama: Yushan; 23°28' N, 120°57' E.
Oiwake [Musha]: Cuifeng, in Ren-ai Township, Nantou County; 24°06.5' N, 121°12' E, alt. 2,295 m.
Paroe [= Old name of Daibu]: Dawu, in Dawu Township, Taitung County; 22°22' N, 120°54' E, alt. 5 m.
Piyanan: Nashan, in Datong Township, Yilan County; 24°24' N, 121°22' E, alt. 1210 m.
Piyanan-anbu: Saiyuanyakou, in Datong Township, Yilan County; 24°24' N, 121°21' E, alt. 1.925 m.
Rahao: Lahao, in Jianshi Township, Hsinchu County; 24°43.5' N, 121°16' E, alt. 540 m.
Rahau: Naxiao [Xinxian], in Wulai Township, Taipei County; 24°50' N, 121°31.5' E, alt. 350 m.
Raisha: Laiyi, in Laiyi Township, Pintung County; 22°31.5' N 120°40.5' E, alt. 545 m.
Rakuraku: Lele, in Hsinyi Township, Nantou County; 23°33' N, 120°57.5' E, alt. 1,695 m.
Rantaizan: Lantashan, in Hsinyi Township, Nantou County; 23°41.5' N, 120°57' E, alt. 3,080 m.
Rarasan [or Mt. Rara]: Lalashan, in Fusing Township, Taoyuan County; 24°42' N, 121°25' E, alt. 1,665 m.
Rato: Luodong, in Luodong Township, Yilan County; 24°41' N, 121°46' E, alt. 5–10 m..
Rengechi: Cunshang, in Dacun Twonship, Changhua; 23°59' N, 120°34' E, alt. 20 m.
Rikiriki: Lili, in Chunri Township, Pintung County; 22°26' N, 120°39' E, alt. 140 m.
Rimogan: Fushan, in Wulai Township, Taipei County; 24°46.5' N, 121°30' E, alt. 460 m.
Riyohen: Liuxing, in Nanao Township, Yilan County; 24°27' N, 121°38' E, alt. 1,120 m.
Rokki: Liougui, in Liougui Township, Kaohsiung County; 23°00' N, 120°38' E, alt. 245 m.
Rono [or Rônô] in Kizan-gun: Launong, in Liougui Township , Kaohsiung County; 23°04.5' N, 120°40.5' E, alt. 405 m.
Ryutan [Rigyotan]: Liyutan, in Shoufeng Township, Hualien County; 23°56' N, 121°30.5' E, alt. 140 m.
Sankaikeki: Sanmin District, in Kaohsiung City, Kaohsiung County; 22°38.5' N, 120°19.5' E, alt. 10 m.
Sansei: Sansing, Sansing Township, Yilan County; 24°40' N, 121°39' E, alt. 90–100 m.
Saukan in Taiheizan: Biyabo-dengshankou, in Nanao Township, Yilan County; 24°29' N, 121°32' E, alt. 1,895 m.
Shinchiku: Hsinchu City; 24°48.5' N, 120°58' E, alt. 50 m.
Shinsuiei-sha: Jinshuiying, in Daren Township, Taitung County; 22°24.5' N, 120°46' E, alt. 1,450 m.
Shinten: Sindian, Taipei County; 24°57' N, 121°32' E, alt. 40 m.
Sozan [or Sôzan]: Yangmingshan, in Taipei City; 25°09' N, 121°33' E, alt. 450–550 m.
Tabô [or Tabo]: Duowang, in Datong Township , Yilan County; 24°34' N, 121°30' E, alt. 390 m.
Taiheizan : Taipingshan [or Taiping Mountain] , Yilan County; 24°30' N, 121°32' E, alt. 1,900 m.
Taihoku: Taipei; 25°04' N, 121°31' E.
Taihorin: Dapu, in Dapu Township, Chiayi County; 23°18' N, 120°35.5' E, alt. 270 m.
Taiko: Dahu, in Dahu Township, Miaoli County; 24°24' N, 120°52' E, alt. 280 m.
Taiko-san [or Taikozan or Mt. Taiko]: probabaly Dahujian-shan in Fanlu Township, Chiayi County; 23°29' N, 120°37' E, alt. 840 m.
Tainan: Tainan City; 22°59' N, 120°11' E, alt. 10 m.
Taipin: Taipingshan, see Taiheizan; or Taiping City, Taichung County; 24°07N, 120°43' E, alt. 450 m.
Taito [or Taitou]: Taitung City, Taitung County; 22°45.5' N, 121°08.5' E, alt. 0–5 m.
Takao: Kaohsiung, Kaohsiung County; 22°38' N, 120°16' E. alt, 10 m.
Takeyama: Zhushan, in Zhushan Township, Nantou County; 23°45.5' N, 120°41' E, alt. 170 m.
Takezaki: Chuchi, in Chuchi Township, Chiayi County; 23°31' N, 120°33' E, alt. 120 m.
Tamaru (Rato): Tianwan, in Datong Township, Yilan County; 24°39' N, 121°27.5' E, alt. 1,090 m.
Tamazato (Karenko): Yuli, Hualien County; 23°20' N, 121°19' E, alt. 135 m.
Tompo [or Tombo]; Tungpu, in Hsinyi Township, Nantou County; 23°34' N, 120°55' E, alt. 1,200 m.
Ugan (Rato): Somewhere in Rato-gun [Luodong Province] which was comprised of current Luodong Township, Wujie Township, Sanxing Township, Dongshan Township and Datong Twonship in Yilan County ; we failed to specify the exact locality of “Ugan” as it was not given in Chinese characters in any Sonan's article.
Urai: Wulai, in Wulai Township , Taipei County ; 24°52' N, 121°33' E, alt. 145 m.
Yûsho (Piyanan-goe): Yousheng [or Shenguang], in Heping Township, Taichung County; 24°22' N, 121°20' E, alt. 1,820 m.