



# First report of interspecific facultative social parasitism by *Polistes* sp. on *Polistes djakonovi* Kostylev (Hymenoptera: Vespidae) in South Korea

Moon Bo Choi<sup>1,2,\*</sup> and Ohseok Kwon<sup>1</sup>

<sup>1</sup>Institute for Phylogenomics and Evolution, Kyungpook National University, Daegu 41566, Republic of Korea

<sup>2</sup>School of Applied Biosciences, College of Agriculture and Life Sciences, Kyungpook National University, Daegu 41566, Republic of Korea

## Abstract

Social parasitism is occasionally found in some *Polistes* and *Vespa* species, such as *Vespa dybowskii*. We report a discovery of interspecific facultative social parasitism by *Polistes* sp. (possibly *P. mandarinus*) on *Polistes djakonovi* Kostylev in two rural areas of South Korea. *P. djakonovi* is very similar to *Polistes* sp. in its body color patterns except that the mark on the clypeus is different. In nest 1 (65 cells), we found 5 females of *P. djakonovi* and 4 females of *Polistes* sp. on 30 July 2014, whereas nest 2 (102 cells) contained 12 females and 16 males of *P. djakonovi*, and 3 females of *Polistes* sp. on 28 August 2013. Although we found the two nests in July and August, *P. djakonovi* seems to have been exploited by *Polistes* sp. at the end of the preemergence period (early to mid-June). The two nests found in this study had mainly white cocoon caps of *P. djakonovi* with several yellow ones of *Polistes* sp. In most cases of social parasitism, intruders have a larger size of the body or some body parts than the host in order to usurp the host; in contrast, this study showed that the hosts had larger bodies than the intruders.

**Key words:** interspecific facultative, *Polistes*, social parasitism

## INTRODUCTION

In various organisms, parents invest a large amount of energy to supply food and take care of their brood. Some of them raise their young by exploiting nests of conspecifics or heterospecifics to reduce their energy consumption (Davies et al. 1989). This phenomenon, called social parasitism, is well known in birds such as cuckoos (Payne 1977) and social insects such as ants, bees, and wasps (Wilson 1971).

Social parasitism is classified into intraspecific or interspecific and facultative or obligate. Facultative parasitism is an alternative strategy to rear the brood, while obligate

parasitism is a complete dependence on another species for this purpose (Cervo 2006). Among social insects, several polistinae species and *Vespa dybowskii* (Vespidae) are well known as social parasites (Matsuura and Yamane 1984, Cervo and Dani 1996, Carpenter 1997, Cervo et al. 2004, Cervo 2006).

Among Polistinae, obligate social parasitism is present in *Polistes sulcifer*, *Polistes atrimandibularis*, and *Polistes semenowi* (Carpenter 1997), whereas facultative social parasitism is present in the following pairs of species: the nests of *Polistes fuscatus* are usurped by *Polistes apachus*

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\*Corresponding Author

E-mail: [kosinchoi@hanmail.net](mailto:kosinchoi@hanmail.net)

Tel: +82-53-950-5762

[www.kci.go.kr](http://www.kci.go.kr)

(Snelling 1952), those of *Polistes instabilis* are usurped by *Polistes canadensis* (O'Donnell and Jeanne 1991), those of *Polistes versicolor* by *Polistes lanius*, (Giannotti 1995), those of *Polistes dominulus* by *Polistes nimphus* (Cervo et al. 2004), and those of *Polistes gallicus* by *Polistes dominulus* (Cervo and Dani 1996). This social parasitism occurs at a rate of 0.3-7.6% in the field (Cervo et al. 2004). Elaborate intruder's tricks such as morphological, chemical, and behavioral similarities to the host account for the mechanism of social parasitism (Dapporto et al. 2004, Cervo 2006, Cini et al. 2011, Montagna et al. 2012).

In South Korea, cases of social parasitism have been reported in *V. dybowskii* and *Vespula austriaca* (Choi et al. 2013), but little is known about social parasitism among *Polistes* species. In this study, we report for the first time social parasitism found in South Korea between two *Polistes* species.

## MATERIALS AND METHODS

Two *P. djakonovi* nests were observed in the rural areas of Machi-ri (N 35°47'35.05" E 127°15'30.48"), Wanjugun, Jeonbuk Province (nest 1) and Bongsan-myeon (N 36°9'5.77" E 128°4'0.57"), Gimcheon-si, Gyungbuk Province (nest 2), South Korea.

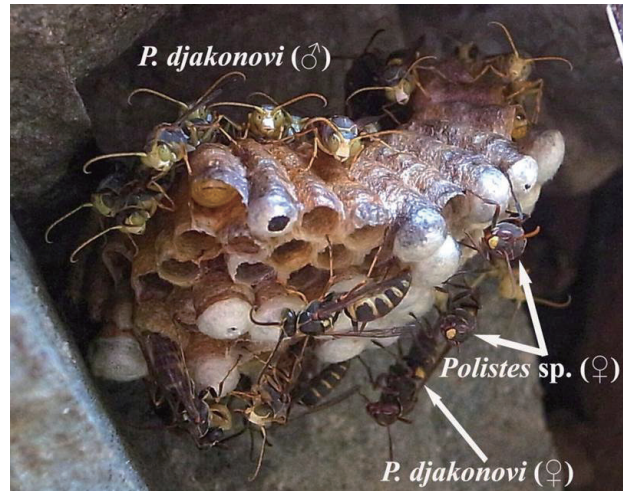
The inquilines in the two nests were *P. djakonovi* and *P. mandarinus*, but Nguyen and Kojima (2014) have suggested that *P. mandarinus* may need reidentification in Korea. Therefore, we use the term *Polistes* sp. until identification of this species is confirmed. The images of specimens were taken using a Leica M125 stereomicroscope (Leica MICROSYSTEMS, Wetzlar, Germany) equipped with a Leica DFC450 camera (Leica MICROSYSTEMS).

## RESULTS AND DISCUSSION

*Polistes djakonovi* Kostylev and *Polistes* sp. are widespread in South Korea and are frequently collected in forests, rural areas, and green suburban areas. These species nest on shrub branches (Choi et al. 2012a, 2012b, 2014).

In this study, two nests of *P. djakonovi* exploited by *Polistes* sp. were found, representing a case of interspecific facultative social parasitism. Nest 1 (65 cells) contained 5 females of *P. djakonovi* and 4 females of *Polistes* sp. on 30 July 2014. Nest 2 (102 cells) contained 12 females and 16 males of *P. djakonovi* and 3 females of *Polistes* sp. on 28 August 2013 (Fig. 1).

Most cases of social parasitism occur during the pre-



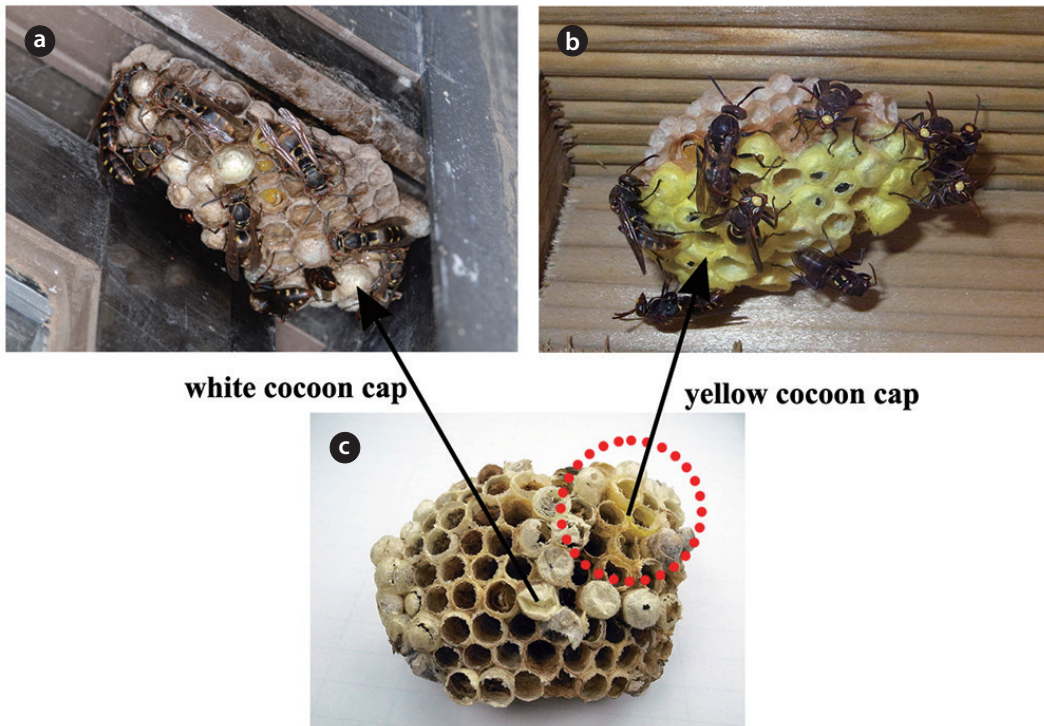
**Fig. 1.** Social parasitism by *Polistes* sp. on *Polistes djakonovi* in nest 2 on 28 August, 2013.

emergence period (Cervo et al. 2004). The timing of the life cycle and nesting sites have to be matched between the intruder and host for social parasitism to take place (Cervo 2006, Montagna et al. 2012). We believe that social parasitism between these two species is possible because their life cycles and nesting sites overlap in South Korea. Although we found the two nests in July and August, *P. djakonovi* seems to have been exploited by *Polistes* sp. at the end of the preemergence period (early and mid-June).

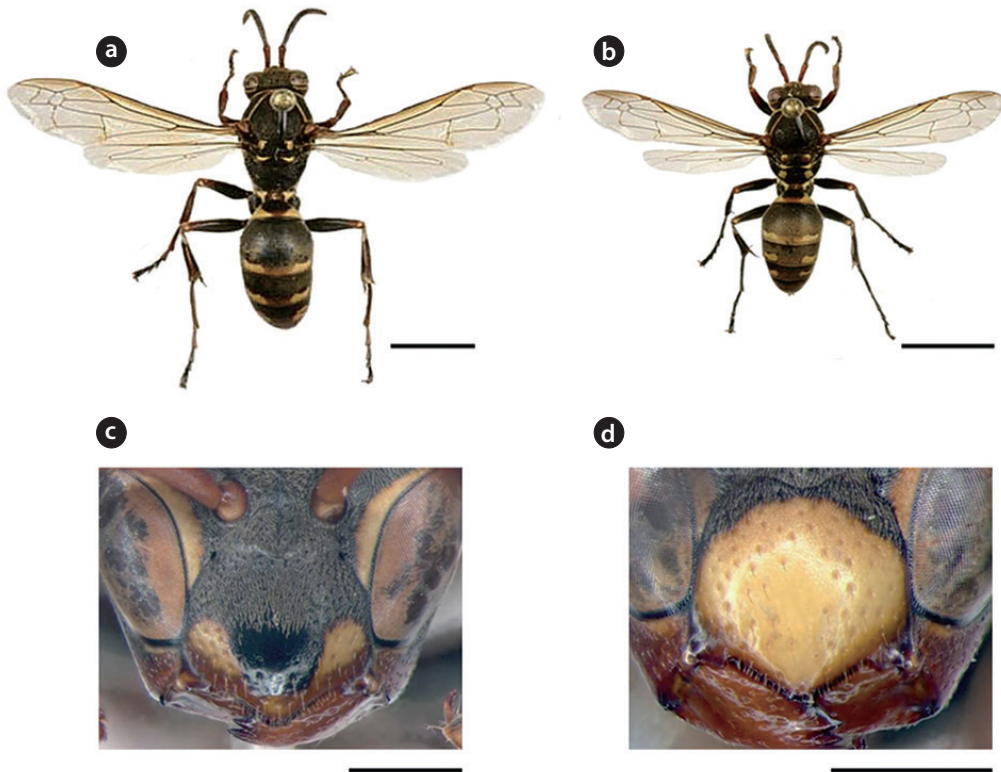
Typical *P. djakonovi* nests have white cocoon caps (Fig. 2a), whereas those of *Polistes* sp. have yellow cocoon caps (Fig. 2b). The two nests found in this study had mainly white cocoon caps with several yellow ones (Fig. 2c), which is a clear evidence of social parasitism.

Social parasitic species are more phylogenetically closely related to their hosts than to other species (Emery 1909, Lowe et al. 2002). Therefore, morphological similarities between the two *Polistes* species must have been a prerequisite for social parasitism. *P. djakonovi* and *Polistes* sp. are very similar in their morphology except the differences in the mark on the clypeus and their size (Fig. 3).

To usurp its host, an intruder usually needs to have a larger body size than the host; even if the intruder has a smaller body than the host, body parts used for fighting such as the head, first femur, and posterior tibia are more developed (O'Donnell and Jeanne 1991, Cervo 1994, Giannotti 1995, Cervo and Dani 1996, Cervo et al. 2004). However, the results for the two species in this study were opposite: the host had a larger body than the intruder (Fig. 3a and 3b). Although this study could not fully address the mechanism of the relationship between these social parasitic species, their ecology should be studied in the future.



**Fig. 2.** Identification of social parasitism by its cocoon caps color. (a) Typical nest of *Polistes djakonovi* with white cocoon caps, (b) Typical nest of *Polistes* sp. with yellow cocoon caps, (c) Nest of *P. djakonovi* usurped by *Polistes* sp.; white and yellow cocoon caps coexist in the same nest.



**Fig. 3.** Morphological similarity of *Polistes djakonovi* and *Polistes* sp. Color pattern: general habitus (a, b) and the clypeus (c, d) of *P. djakonovi* (a, c) and *Polistes* sp. (b, d). Scale bars: 5.0 mm (a, b), 1.0 mm (c, d).



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