

Taxonomic study of the *Glyphodes* genus group (Crambidae: Spilomelinae) in Japan and its adjacent countries

ロスフィアンシャー

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Title : Taxonomic study of the *Glyphodes* genus group (Crambidae: Spilomelinae) in Japan and its adjacent countries
(日本とその近隣国における *Glyphodes* 属群 (ツトガ科: Spilomelinae 亜科) の分類学的研究)

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Thesis Summary

The Glyphodes genus group includes *Glyphodes*, *Agrioglypta*, *Talanga*, and *Dysallacta* belonging to Spilomelinae (Hampson, 1896; Common, 1990; Shafer *et al.*, 1996; Sutrisno, 2002; Mally *et al.*, 2019). The *Glyphodes* genus group belongs to the tribe Margaroniini (Mally *et al.*, 2019), the subfamily Spilomelinae of the family Crambidae. The family Crambidae consists of 4,090 species worldwide in 339 genera (Nuss *et al.*, 2003–2020). These genera have host plant similarities, in general has specific host plants where it has been reported that the larvae of the species have the most latex-containing host plants such as Moraceae and Apocynaceae (Common, 1990; Robinson *et al.* 1994; Robinson *et al.*, 2010).

Currently, 11 species of *Agrioglypta* are described in the world (Mally *et al.*, 2019) and more than 17 species of *Agrioglypta* are estimated to have been found worldwide (Robinson *et al.*, 1994) and only two species have been recorded in Japan (Sasaki & Yamanaka, 2013). In addition, 92 species of *Glyphodes* in the world and 13 species in Japan, 17 species of *Talanga* in the world and two species in Japan, 49 species of *Parotis* in the world and three species in Japan are recorded (Sasaki & Yamanaka, 2013). However, taxonomy of this group is still insufficient and there are several problematic species: unknown species of *Agrioglypta* is known even in Japan. On the other hand, Sutrisno (2002) carried out cladistic analysis based on morphological characters. However, he did not include other related genera such as *Diaphania*, *Cydalima*, and *Parotis*.

Objectives of the present study is to explore the species diversity of *Glyphodes* genus group in Japan and its adjacent countries based on morphological characters and DNA barcoding and to clarify phylogenetic position of *Glyphodes* genus group and other related genera by comparison with previous cladistic analysis of Sutrisno (2002)

For the taxonomic study, the specimens deposited in museums collections were examined. The field trip was also performed to collect materials in some localities in Japan. The specimens were identified based on their external and genital characters. For the molecular identification, the DNA barcoding (using mitochondrial COI partial gene) was performed and computed the genetic distances in MEGA 7 (Kumar *et al.*, 2016). To clarify the relationship of genera and species of the *Glyphodes* genus group, a total of 39 morphological characters of adults and male and female genitalia (Sutrisno, 2002) were used for cladistic analysis by the addition of 32 *Glyphodes* genus group species and three species of other genera of Spilomelinae as outgroup. The data were analyzed by maximum parsimony (MP) method in PAUP 4 (Swofford, 1998).

As a result, a total of 32 species belonging to four genera were recognized, including eight new species and one newly recorded species from China and Vietnam. Based on the molecular analysis, the unknown species *Agrioglypta* is described as *A. fulguralis* (Rosfiansyah *et al.*, 2021). This species is morphologically different from *A. itysalis* and other *Agrioglypta* species, and has a large difference in genetic distances from *A. itysalis* found in Japan (5.6%).

A. zelimalis was found as newly recorded species from China and Vietnam. *Agrioglypta* sp. 3 from Thailand (also recorded in China) had similar morphological character in the male genitalia with *A. itysalis*, *A. fulguralis*, and *Agrioglypta* sp. 2. *Glyphodes* sp. 1 (Hainan, China), *Glyphodes* sp. 2 (Guangdong, China), and *Glyphodes* sp. 3 (Chanthaburi, Thailand) are similar to *Glyphodes actorionalis*. *Parotis* sp. 1 from Palau is similar to *P. sularis*.

The results based on cladistic analysis of the *Glyphodes* genus group in Japan and its adjacent countries showed that the genus *Glyphodes* is divided into three groups, which are not monophyletic. In addition, *Diaphania*, *Cydalima*, and *Parotis* are included to the *Glyphodes* genus group. In the present study, the *Glyphodes* genus group is characterized by two synapomorphies: the broadly triangular to rounded tegumen with a sharp cleft at the apex and the funnel-shaped ductus bursae posteriorly. This is different from the result of Sutrisno (2002), in which *Glyphodes* genus group falls into three monophyletic groups and the synapomorphy was regarded as paired signum with blunt denticles. The broadly rounded tegumen with sharply invaginated at the apex was regarded as a synapomorphy of the *Glyphodes* group 1 by Sutrisno (2002), but this condition and coremata with long hairs and scale tufts are considered as a synapomorphy of *Glyphodes* group 1 + *Diaphania* + *Cydalima* + *Parotis* in the present study.

Talanga quadrimaculalis is considered to be sister to other *Talanga* + *Agrioglypta* by sharing the narrow juxta with a short well-sclerotized rod-like medial process. In this group, the phallus and ductus bursae are extremely elongated and this condition is almost correlated in each species. The extremely elongated condition in *Talanga* and *Agrioglypta* is considered to have derived from very short type in the outgroup, via medium type in other species.