Revision of *Nagiella* Munroe (Lepidoptera, Crambidae), with the description of a new species from China

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Abstract

The genus *Nagiella* was studied using morphological and DNA barcode data. *Nagiella bispina* sp. nov. is described as a new species, and *N. hortulatoides* Munroe is recorded in China for the first time. The diagnosis of this genus is revised, and the genitalia description of *N. quadrimaculalis* (Kollar and Redtenbacher) and *N. inferior* (Hampson) are given in English for the first time. *Nosophora incomitata* (Swinhoe) stat. rev. is removed from the synonym of *N. quadrimaculalis*. Photographs of the habitus and genitalia as well as COI DNA Barcode data of these four species are provided.

Keywords

DNA barcodes, Maximum Likelihood analysis, morphology, Pyraloidea, Spilomelinae

Introduction

*Nagiella* Munroe, 1976 is the objective replacement name of *Nagia* Walker, 1866, with *N. desmialis* Walker, 1866 as the type species. Swinhoe (1894) described two species of *Nagia* and mentioned that *Nagia quadrimaculalis* (Kollar & Redtenbacher, 1844) = *Nagia desmialis*. However, Hampson (1899) regarded *Nagia* as a synonym of *Syllepte* Hübner, 1823 and his opinion was followed by some researchers (Shibuya 1928, 1929; Klima 1931, 1939a). Munroe (1976) proposed that *Nagiella* and *Syllepte* were different in genitalia and type of maculation and mentioned that the type species, *N. desmialis*,...
was generally considered a synonym of \textit{Scopula quadrimaculalis}. Munroe's opinion was followed by some researchers (Kirti and Sodhi 2001; Rose 2002; Ullah et al. 2017). In addition, \textit{Nagiella} was regarded as a synonym of \textit{Pleuroptya} Meyrick, 1890 (= \textit{Patania} Moore, 1888) (Kirpichnikova 1987; Leraut 1997), and \textit{Scopula quadrimaculalis} and \textit{Sylepta inferior} were placed in \textit{Pleuroptya} for a long time (Inoue 1982; Wang and Speidel 2000; Bae et al. 2008; Du 2009; Heppner 2012; Sasaki and Yamanaka 2013). Ullah et al. (2017) regarded \textit{Nagiella} as a valid genus and published one cryptic species of it. Mally et al. (2019) placed \textit{Nagiella} in Agroterini Acloque, 1897 based on morphological characteristics.

To date, four species of \textit{Nagiella} have been identified worldwide, and they have been recorded in the Palaearctic and Oriental realms. These species are all distributed in China, with \textit{N. hortulatoides} Munroe, 1976 being recorded in China for the first time in this study. \textit{Nagiella inferior} and \textit{N. quadrimaculalis} are widely distributed in the Palaearctic and Oriental realms (Wang 1980; Inoue 1982; Bae et al. 2008; Du 2009; Sasaki and Yamanaka 2013), with the latter species also recorded from Central Africa (Ghesquière 1942). In addition to China, \textit{N. hortulatoides} is distributed in Myanmar. \textit{Nagiella occultalis} Misbah & Yang in Ullah et al. 2017 is only distributed in China (Ullah et al. 2017). In this study, one new species, \textit{Nagiella bispina}, is described based on morphological and DNA barcode data, and the diagnosis of this genus is revised.

\section*{Materials and methods}

\subsection*{Taxon sampling}

The specimens were collected by light trap at night and killed by ethyl acetate or ammonium hydroxide. The specimens are deposited in the College of Plant Protection, Southwest University, Chongqing, China (SWUCPP) and the Institute of Zoology, Chinese Academy of Sciences, Beijing (IOZ). Information on the specimens from which the DNA Barcode region of the COI gene was sequenced is shown in Table 1. In total, 24 sequences were analysed in this study, with eight being from the BOLD database (Ratnasingham and Hebert 2007; http://v4.boldsystems.org/). The sequences obtained from our laboratory have been uploaded to BOLD.

Genitalia preparation mainly follows Li and Zheng (1996). Images of the adults were captured with a digital camera (Nikon P7700), and images of the genitalia were captured with a digital camera (Leica DFC 450) attached to a digital microscope (Leica M205 A).

\subsection*{DNA extraction, PCR amplification, and sequencing}

In total, all five species of \textit{Nagiella} were included for PCR analysis and DNA sequencing (Table 1). Total DNA from legs of fresh or dry specimens was extracted using the TIANGEN DNA Kit following the manufacturer's instructions, and the 658-base pair (bp) barcode region of COI was amplified using the LepF1/LepR1 primers (Hajiba-
Table 1. Sample information for the *Nagiella* and outgroup specimens included in the study.

| Species | Sequence ID | Location (China) | BOLD Accession NO. |
|---------|-------------|------------------|--------------------|
| *N. hortulatoides* Munroe, 1976 | LXQ180100 | Yunnan | DULU001-19 |
|          | LXQ180099 | Yunnan | DULU002-19 |
|          | LXQ180217 | Yunnan | DULU003-19 |
| *N. inferior* (Hampson, 1899) | LXQ180251 | Hubei | DULU004-19 |
|          | LXQ180127 | Yunnan | DULU005-19 |
|          | Pyr000509 | Shanxi | CNPYD509-10 |
|          | Pyr000508 | Shanxi | CNPYD508-10 |
| *N. quadrimaculalis* (Kollar & Redtenbacher, 1844) | XD1405327 | Sichuan | GBMIN79565-17 |
|          | XD1402131 | Hainan | DULU006-19 |
|          | XD1402129 | Hubei | DULU007-19 |
|          | Pyr002264 | Shanxi | CNPYB413-16 |
|          | Pyr002266 | Shanxi | CNPYB415-16 |
|          | Pyr000498 | Hubei | CNPYD498-10 |
| *N. occultalis* Misbah & Yang in Ullah et al. 2017 | Pyr002290 | Shanxi | CNPYB439-16 |
|          | Pyr002397 | Shanxi | CNPYB407-16 |
|          | Pyr000499 | Hubei | CNPYD499-10 |
| *N. bispinosa* sp. nov. | LXQ180091 | Guangdong | DULU008-19 |
|          | LXQ180092 | Guangdong | DULU009-19 |
| *Patania balteata* (Fabricius, 1798) | XD1405399 | Sichuan | GBGL38467-19 |
|          | XD1405300 | Sichuan | GBMIN79548-17 |
|          | XD1405441 | Sichuan | GBGL38468-19 |
| *P. chlorophanta* (Butler, 1878) | XD1404265 | Guangxi | GBMIN79550-17 |
|          | XD1404239 | Guangxi | GBMIN79549-17 |
|          | XD1401035 | Guangxi | GBMIN79551-17 |

baei et al. 2006). PCR products were sent to Sangon Biotechnology Co., Ltd. (Shanghai, China) for sequencing using the aforementioned primers.

**Data analysis**

All COI sequences were aligned by MEGA 7.0 (Kumar et al. 2016) and adjusted visually after being translated into amino acid sequences. Intraspecific and interspecific genetic divergence values were quantified based on the Kimura 2-parameter (K2P) distance model (Kimura 1980). Phylogenetic analysis was performed based on Maximum Likelihood (ML) with the GTR GAMMA model of nucleotide substitution, and with 1000 bootstrap replicates (Stamatakis et al. 2008). *Patania balteata* and *P. chlorophanta* were chosen as the outgroup species as they were members of the same tribe (Agroterini), but not congeneric with *Nagiella*.

**Results**

**DNA sequence analysis**

Overall, 24 COI sequences, including six of the outgroup species, were analysed. The dataset contained no obvious pseudogenes, indicating the correct target gene sequence was amplified and sequenced.
Five monophyletic clades for *Nagiella* were observed in the resulting phylogenetic tree (Fig. 1). The pairwise genetic distances within and between these lineages are given in Table 2. The average intraspecific genetic distance ranged from 0.00 to 0.02%, while the average interspecific genetic distance ranged from 3.30 to 9.46%. The maximum intraspecific COI genetic distance was much less than the minimum interspecific distance. The monophyla observed in the phylogenetic analysis were in full congruence with our morphological hypotheses for the investigated species (Fig. 1).

**Taxonomy**

*Nagiella* Munroe, 1976

*Nagia* Walker, 1866: 1320 (preocc.). Type species: *Nagia desmialis* Walker, 1866, by monotypy.

*Nagiella* Munroe, 1976: 876. Type species: *Nagia desmialis* Walker, 1866, by monotypy (of *Nagia* Walker, 1866).

**Diagnosis.** Frons rounded. Labial palpus broad, obliquely upturned and curved, compressed, third joint extremely minute, short and stout (Fig. 2). Male antenna with ventral cilia. Legs smooth. Fore wings near rectangular at the tips; length of cell ap-
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Table 2. Kimura 2-parameter genetic distances in percent, calculated within (in bold) and between species of Nagiella.

|                | 1      | 2      | 3      | 4      | 5      |
|----------------|--------|--------|--------|--------|--------|
| 1 N. hortulatoides (N = 3) | 0.20   |        |        |        |        |
| 2 N. inferior (N = 4)         | 6.87   | **0.00** |        |        |        |
| 3 N. quadrimaculalis (N = 6)  | 4.87   | 6.68   | 0.09   |        |        |
| 4 N. occultalis (N = 3)       | 4.00   | 5.16   | 3.30   | **0.00** |        |
| 5 N. bispina sp. nov. (N = 2) | 8.95   | 9.46   | 8.80   | 7.57   | **0.00** |

Remarks. According to Munroe (1976) and Ullah et al. (2017), Nagiella can be differentiated from its similar genera by its short and wide uncus, developed gnathos, broader valva with stout setae subapically, large oblique clasper and absence of cornuti, as well as by the type of wing maculation. In N. bispina sp. nov., however, the gnathos is absent, the valva costa has no stout setae, and cornuti are present. Other morphological and DNA barcode data of this new species indicate it as a member of the genus. Therefore, the diagnosis of Nagiella was revised based on previous studies and our research, including supplementation of the wing venation.

Key to species of Nagiella based on morphology and genitalia

1. Wings white, forewing with discoidal spot round .......... N. hortulatoides

– Wings brown, forewing with discoidal spot squarish ........................................ 2

2. Gnathos absent, phallus with a hook-shaped cornutus .... N. bispina sp. nov.

– Gnathos present, phallus without cornutus .................................................. 3

3. Uncus with setae on distal half; gnathos stubby, finger-like or tuberculi-form ................................................................. N. inferior

– Uncus without setae; gnathos slender, finger-like ........................................ 4

4. Forewing with white spot between orbicular spot and discoidal spot proportionally narrowed or elongate; uncus with distal margin slightly concave ........................................................................ N. occultalis

– Forewing with white spot between orbicular spot and discoidal spot nearly square or rectangular; uncus with distal margin truncate ... N. quadrimaculalis
Figures 2, 3. Head and wing venation of *Nagiella quadrimaculalis* (Kollar & Redtenbacher, 1844). Wing slide no. LXQ20001, male.

*Nagiella hortulatoides* Munroe, 1976

Figures 4, 9

*Nagiella hortulatoides* Munroe, 1976: 876, figs 2, 14, 19.

**Material examined.** China, Yunnan: 10 ♂♂, Honghe Prefecture, Huanglian Mountain, 900 m, 27.V.2018, leg. Xiao-Qiang Lu & Xi-Cui Du. Genitalia slide no.: LXQ18170 ♂, LXQ18187 ♂, LXQ18311 ♂.

**Diagnosis.** Adult (Fig. 4): Frons, palpi, basal antenna, most of vertex black. Thorax orange with blackish-fuscous spot. Wings white, light orange at base, maculation grey, with terminal line white, discontinuous. Forewing with orbicular spot and discoidal spot round, a large elongate elliptical spot from base to orbicular spot below cell; grey terminal area broad, with inside concave between M₁ and CuA₂. Hindwing with discoidal spot round; grey terminal area broad, with inside slightly concave between M₂ and CuA₂. Abdomen with first and second segment orange with three black spots, the rest grey. Male genitalia (Fig. 9): Uncus trapezoidal. Gnathos slender, finger-like. Valve elongate lingulate, posterior margin with clusters of long setae near middle and terminal, clasper thickly finger-like. Female genitalia: Corpus bursae with a round signum (Munroe 1976).

**Distribution.** China (Yunnan), Myanmar (Munroe 1976).

**Remarks.** This species is recorded for the first time in China.
Figures 4–8. Habitus of Nagiella species 4 N. bortulatoides male 5 N. inferior male 6 N. quadrimaculalis male 7 Nagia incomitata Swinhoe 1894 female, type, BMNH Pyr., London. 7A head 8 Nagiella bispina sp. nov. male, holotype.

**Nagiella inferior** (Hampson, 1899)
Figures 5, 10, 13

*Sylepta* [sic] *inferior* Hampson, 1899: 724.
*Botys quadrimaculalis* Motschulsky, 1861: 37.
*Nagiella inferior* Munroe, 1976: 876.
*Pleuroptya inferior* Inoue, 1982: 343.

**Material examined.** China, Liaoning: Huanren County, Laotuding, 28.VII.2012, leg. Dan-Dan Zhang & Li-Jun Yang (SYSU); Gansu: 1 ♂, Kangxian County, Baiyun Mountain, 1200 m, 3.VII.2018, leg. Xiao-Qiang Lu & Xi-Cui Du; Shanxi: 1 ♂, Jincheng
City, Manghe, 725 m, 28.VI.2018, leg. Xiao-Qiang Lu & Xi-Cui Du; Shaanxi: Ningxia County, Xunyangba Town, 1400 m, 4.VIII.2014, leg. Jiu-Yang Luo & Kai-Li Liu; 3 ♂♂, Taibai County, Huangbaiyuan Town, 1200 m, 19.VIII.2014, leg. Kai-Li Liu; 6 ♂♂, 1 ♀, Baojilong County, 900 m, 6.VII.2018, leg. Xiao-Qiang Lu & Xi-Cui Du; Hubei: 15 ♂♂, Dabie Mountain, Taohua Village, 590 m, 25–28.VI.2014, leg. Li-Jun Xu; 2 ♂♂, Xiangyang City, Maqian Town, 1100 m, 19.VI.2018, leg. Xiao-Qiang Lu & Xi-Cui Du; Zhejiang: 1 ♂, Jiulong Mountain, 50 m, 4.VIII.2011, leg. Xiao-Bing Fu; 9 ♂♂, Tianmu Mountain Nature Reserve, 400 m, 25–28.VII.2011, leg. Xi-Cui Du & Xiao-Bing Fu; 4 ♂♂, Qingliangfeng Nature Reserve, 300 m, 18–22.V.2012, leg. Xiao-Bing Fu; Tibet: Motuo County, Didong Village, 840 m, 15.VIII.2006, leg. Fu-Qiang Chen (IOZ); Chongqing: 1 ♂ Jingfoshan Nature Reserve, 679 m, 15.IX.2018, leg. Xi-Cui Du; 1 ♂, Hechuan Farm, 230 m, 3.VII.2009, leg. Xi-Cui Du; 6 ♂♂, Chengkou County, Dongan Village, xingtian Village, 1300 m, 26.VI.2013, leg. Gui-Qing He & Li-Jun Xu; Sichuan: 2 ♂♂, Tongjiang County, Nuoshui River Scenic Area, 700 m, 5.VII.2013, leg. Gui-Qing He & Dan Xu; 1 ♂, Nanjiang County, Guangwu Mountain, 900 m, 10.VII.2013, leg. Gui-Qing He & Li-Jun Xu; 1 ♂, 2 ♀, Huagaoxi Nature Reserve, Guandou Village, 763 m, 11.X.2014, leg. Li-Jun Xu & Dan Xu; Guizhou: 1 ♂, Kuankuosu, Baishao, 800 m, 12.VIII.2010, leg. Xi-Cui Du; 1 ♂, Maolan Nature Reserve, Lanei Village, 806 m, 24.VII.2015, leg. Dan Xu; Yunnan: 2 ♂♂, Honghe Prefecture, Ma’andi, 1300 m, 14.V.2015, leg. Xue-Li Wei; 2 ♂♂, Xishuangbanna Prefecture, Menglong Town, 620 m, 17.V.2018, leg. Xiao-Qiang Lu & Xi-Cui Du; Guangxi: 1 ♂, Longzhou, Nonggang, 188 m, 26.VII.2011, leg. Gui-Qing He; 1 ♂, Jingxiu, Shengtang Mountain, 600 m, 28.VII.2011, leg. Li-Yang Jun; 1 ♂, Jinfo Mountain, Miaozi, 1450 m, 31.VII.2014, leg. Xue-Li Wei & Chao Ran; 3 ♂♂, Chengkou County, Longdaping, 1290 m, 10.VIII.2014, leg. Xue-Li Wei & Chao Ran; 1 ♂, Hechi, Jiujiang County, 1600 m, 23.VII.2015, leg. Ji-Ping Wan; Hainan: Wuzhi Mountain, 795 m, 20.V.2014, leg. Li-Jun Xu & Xu Dan. Genitalia slide no.: XLJ13114 ♂, XLJ14053 ♂, XLJ14219 ♂, LXQ18284 ♂, LXQ18291 ♂, LXQ18303 ♂, XLJ14220 ♀, XLJ14239 ♀.

**Diagnosis.** Adult (Fig. 5): Wings brown. Forewing length 10.0–12.5 mm (wing-span 22.0–28.0 mm); a small white spot between the orbicular spot and discoidal spot; a large white subreniform spot between the discoidal spot and postmedial line, up to Rs₂+Rs₃ and down to CuA₁; antemedial and postmedial line unclear. Hindwing with a large white irregular quadrilateral spot between the discoidal spot and postmedial line, dentated between M₂ and M₃. Male genitalia (Fig. 10): Uncus trapezoidal, distal half with setae. Gnatous stubby, finger-like or tuberculiform. Clasper thin, finger-like. Female genitalia (Fig. 13): Signum round, very small.

**Male genitalia** (Fig. 10). Uncus trapezoidal, slightly concave terminally, distal half with setae. Gnatous stubby, finger-like or tubercle-like. Valva elongate lingulate, slightly narrowed, terminal with a crowd of long setae, posterior margin with a cluster of long setae near the middle and slightly concave distally; clasper thin, finger-like, constricted near middle. Saccus conical, broad. Juxta semi-circular. Phallus longitudinally wrinkled distally.
Female genitalia (Fig. 13). Apophyses anteriores ca. twice the length of apophyses posteriores. Ductus bursae ca. twice the length of corpus bursae; ductus seminalis from the middle of ductus bursae. Corpus bursae oval, with a very small leaflike signum.

Distribution. China (Liaoning, Gansu, Shanxi, Shaanxi, Henan, Hubei, Zhejiang, Jiangsu, Jiangxi, Tibet, Sichuan, Chongqing, Guizhou, Yunnan, Guangdong, Guangxi, Hainan, Fujian, Taiwan), Korea, Japan, India, Russia (far east) (Hampson 1899; Inoue 1982; Du 2009).

Nagiella quadrimaculalis (Kollar & Redtenbacher, 1844)  
Figures 6, 11, 14

Scopula quadrimaculalis Kollar & Redtenbacher, 1844: 492.
Nagia desmialis Walker, 1866: 1320.
Omioides quadrimaculalis: Meyrick, 1890: 441.
Botys quadrimaculalis: Snellen, 1890: 589.
Sylepta [sic] quadrimaculalis: Hampson, 1896: 336.
Sylepta [sic] desmialis: Swinhoe, 1906: 293.
Nagiella quadrimaculalis: Munroe, 1976: 876.
Pleuroptya quadrimaculalis: Inoue, 1982: 343.

Material examined. China, Gansu: 4 ♂♂, 3 ♀♀, Kangxian County, Baiyun Mountain, 1200 m, 3.VII.2018, leg. Xiao-Qiang Lu & Xi-Cui Du; Shanxi: 4 ♂♂, Lishanxiachuan Nature Reserve, 1560 m, 26.VII.2012, leg. Gui-Qing He; Shaanxi: 11 ♂♂, Ningshan County, Yangjuba Town, 1400 m, 4.VIII.2014, leg. Hai-Li Yu & Jiu-Yang Luo; 7 ♂♂, 8 ♀♀, Yang County, 3500 m, 15.VIII.2017, leg. Jian-Yue Qiu & Hao Xu; 7 ♂♂, 1 ♀, Taibai County, Huangbaiyuan, 1291 m, 16.VII.2018, leg. Qing-Ming Liu; Henan: 33 ♂♂, Neixiangbaotianman Nature Reserve, Luotiofeng, 1300 m, 8.VI.2017, leg. Jian-Yue Qiu & Hao Xu; Hubei: 28 ♂♂, 3 ♀, Dabie Mountain, Taohua Village, 590 m, 20.VII.2010, leg. Li-Jun Xu; 4 ♂♂, Luotian County, Qingguantai, 580 m, 1.VII.2014, leg. Jiu-Yang Luo; 11 ♂♂, Changyang County, Hejiaping, 800 m, 18.VI.2018, leg. Xiao-Qiang Lu & Xi-Cui Du; 4 ♂♂, Wufeng River, 1100 m, 26, VII.2018, leg. Jian-Yue Qiu & Hao Xu; Hunan: 7 ♂♂, Shimen County, Huping Mountain, Dadongping, 1400 m, 8.VI.2017, leg. Jian-Yue Qiu & Hao Xu; 5 ♂♂, Sangzhi County, tianping Mountain, 1400 m, 15.VII.2018, leg. Jian-Yue Qiu & Hao Xu; 6 ♂♂, 2 ♀♀, Yizhang County, Mangshan Nature Reserve, 1000 m, 2.VIII.2018, leg. Jian-Yue Qiu & Hao Xu; Zhejiang: 10 ♂♂, Tianmu Mountain Nature Reserve, 400 m, 26–29.VII.2011, leg. Xiao-Bing Fu & Xi-Cui Du; 11 ♂♂, 3 ♀♀, Qingliang Mountain, Shunxiwu, 300 m, 18–21.V.2012, leg. Xiao-Bing Fu; Jiangxi: 1 ♂, 1 ♀, Jinggangshan City, Xiaoxidong, 625 m, 30.V.2011, leg. Jin-Wei Li; Chongqing: 18 ♂♂, 10 ♀♀, Jingfo Mountain Nature Reserve, 1700 m, 12.VII.2010, leg. Xi-Cui Du & Sheng-wen Shi; 10 ♂♂, Simian Mountain Nature Reserve, 1120 m, 19.VII.2010, leg. Xi-Cui Du & Li-fang Song; 3 ♂♂, Simian Mountain Nature Reserve, 1200 m, 15–19. VII. 2012,
Diagnosis. Adult (Fig. 6): Wings brown. Forewing length 12.0–20.0 mm (wing-span 26.0–43.0 mm); a small white spot between the orbicular spot and discoidal spot; a large white sub-reniform spot between the discoidal spot and postmedial line, up to Rs$_2$+Rs$_3$ and down to CuA$_1$; antemedial and postmedial line unclear. Hindwing with a large white irregular quadrilateral spot between the discoidal spot and postmedial line, dentated between M$_2$ and M$_3$. Male genitalia (Fig. 11): Uncus trapezoidal. Gnathos slender, finger-like. Clasper thickly finger-like. Female genitalia (Fig. 14): Signum small, round.

Male genitalia (Fig. 11). Uncus trapezoidal. Gnathos slender, finger-like. Valva elongate lingulate, with apex narrowed, posterior margin with a cluster of long setae near the middle; clasper thickly finger-like. Saccus conical, broad. Juxta peach-shaped. Phallus longitudinally wrinkled distally.

Female genitalia (Fig. 14). Apophyses anteriores ca. twice the length of apophyses posteriores. Ductus bursae ca. twice the length of corpus bursae, distinctly narrowed near the base; ductus seminalis from approximately one third of the ductus bursae. Corpus bursae oval, with a small round signum.
**Distribution.** China (Heilongjiang, Liaoning, Gansu, Shanxi, Shaanxi, Henan, Hebei, Hubei, Shandong, Hunan, Zhejiang, Jiangxi, Tibet, Sichuan, Chongqing, Guizhou, Yunnan, Guangdong, Guangxi, Hainan, Fujian, Taiwan), Korea, Japan, Indonesia, India (Sikkim), Nepal, Russia (far east), Malaysia (Walker 1866; Inoue 1982; Du 2009).

**Host.** *Rhus chinensis* Mill (Anacardiaceae) (Fan and Piao 2013).

**Remarks.** In addition to *Rhus chinensis* Mill, another host, *Metaplexis japonica* Makino (Apocynaceae), was recorded by Fan and Piao (2013) in the same article according to Yoshiyasu (1991). However, we found *M. japonica* was recorded by Yoshiyasu (1991) as the host of *Glyphodes quadrimaculalis* (Bremer and Grey 1853) but not of *Nagia quadrimaculalis* (Kollar and Redtenbacher). *Rhus chinensis* Mill is the only host of *Nagia quadrimaculalis* (Kollar and Redtenbacher) known so far.

Swinhoe (1894) stated that *Nagia incomitata* was between *Nagia quadrimaculalis* and *Nagia flavispila*, but quite different to either. But *Nagia incomitata* was regarded as a synonym of *Nagia quadrimaculalis* because they were similar in habitus (Bae et al. 2008). We investigated the original description and type specimen of *Nagia incomitata* Swinhoe, 1894, and compared them with the description and photographs of *Nagia quadrimaculalis* (Kollar and Redtenbacher 1844; Du 2009; Sasaki and Yamanaka 2013). The third segment of labial palpus of the former is slender and pointed distally (Fig. 7A), the forewing has no small white spot between the orbicular spot and discoidal spot, and the large white spot beyond the cell is down to the CuA₂ (Fig. 7); while the third segment of labial palpus of the latter is stubby and blunt distally (Fig. 2), the forewing has a small white spot between the orbicular spot and discoidal spot, and the large white spot beyond the cell is down to the CuA₁ (Fig. 6). Therefore, *Nagia incomitata* is not a synonym of *Nagia quadrimaculalis*. *Nagia incomitata* was transferred to *Chalcidoptera* Butler, 1887 by Swinhoe (1901) after stating previously that it did not belong into *Nagia* (Swinhoe 1900). Hampson (1896), on the other hand, considered it a synonym of *Nosophora chironalis* (Walker, 1859), which he later revised (Hampson 1903) by reinstating it as *Nosophora incomitata*, with the junior synonym *Nosophora triguttalis* Warren, 1896. In the same publication on page 216, Hampson (1903) synonymised the males of *Nagia incomitata* with *Sylepta [sic] quadrimaculalis*. For the time being (i.e., until the type material has been investigated), we conclude as Hampson (1903), Klima (1939b), and Mandal and Bhattacharya (1980), who considered *incomitata* a species of *Nosophora*.

*Nagiella occultalis* Misbah & Yang in Ullah et al. 2017

*Nagiella occultalis* Misbah & Yang in Ullah et al. 2017: 70. Figs 2A, 3, 4A, B.

**Note.** Description of the habitus and genitalia was provided by Ullah et al. (2017).

**Distribution.** China (Shaanxi, Hubei) (Ullah et al. 2017).
**Nagiella bispina** sp. nov.
http://zoobank.org/EA3EDE34-1DEA-4FA7-B5A9-70F596B3B2DE
Figures 8, 12, 15, 15A

**Type material.** Holotype ♂, pinned, with genitalia on a separate slide. China, Guangdong: Nanling, Babao Mountain Nature Reserve, 24.98N, 113.03E, 1070 m, 23.VIII.2010, leg. Xi-Cui Du, genitalia slide no. XLJ14011 ♂. *Paratypes.* China, Guangdong: 1 ♂, 1 ♀, same data as holotype. Genitalia slide no.: XLJ14009 ♀, XLJ14134 ♂.

**Diagnosis.** This species is very similar to *N. quadrimaculalis* externally, but can be distinguished from the latter by its rather short and wide uncus with distal margin round, gnathos absent, clasper thick thorn-like, phallus with a hook-shaped cornutus; ductus bursae ca. the same length as corpus bursae with two thorn-like signa (Fig. 15A). In *N. quadrimaculalis*, the uncus is trapezoidal, gnathos is slender and finger-like, clasper is thickly finger-like, and phallus exhibits no cornuti; ductus bursae is ca. twice the length of corpus bursae and corpus bursae has a small round signum (Fig. 14).

**Description.** Adult (Fig. 8). Body brown tinged with copper-colour. Forewing length 11.5–13.5 mm (wingspan 26.0–30.0 mm). Frons, vertex, antenna and maxillary palpus brown. Male antenna with ventral cilia ca. half as long as the diameter of flagellomere. Labial palpus with first and second segments white ventrally, the rest brown. Thorax and abdomen brown dorsally, off-white ventrally. Legs off-white, fore tibia brown distally. Wings brown. Forewing with antemedial line excurred, unclear; orbicular spot and discoidal spot dark brown, the latter squarish; a small white spot between the orbicular spot and discoidal spot; a large white sub-reniform spot between the discoidal spot and postmedial line, up to Rs₂+Rs₃ and down to CuA₁; postmedial line unclear, from ca. 2/3 of the costa, along outer edge of the large white spot, excurred from M₂ to CuA₂, then incurred and nearly vertical to the inner margin below the posterior angle of cell; cilia lightly brown with white basal line. Hindwing with discoidal spot dark brown, short band; a large white irregular quadrilateral spot between the discoidal spot and postmedial line, dentated between M₉ and M₇; postmedial line unclear, along outer edge of the large white spot, lightly excurred from M₂ to CuA₂, then incurred and nearly vertical to the inner margin below the posterior angle of cell; cilia lightly brown with white basal line. Abdomen with each segment white distally.

**Male genitalia** (Fig. 12). Uncus rather short and wide, with distal margin round. Gnathos absent. Valva lingulate, slightly widened; clasper thick thorn-like, with a cluster of long setae at the base. Saccus conical. Juxta near diamond. Phallus with a thick hook-shaped cornutus.

**Female genitalia** (Fig. 15, 15A). Apophyses anteriores ca. twice the length of apophyses posteriores. Ductus bursae ca. the same length as corpus bursae, expanded and sclerotized near the middle; antrum slightly sclerotized; ductus seminalis from expanded part. Corpus bursae oval; two thorn-like signa of different sizes, surrounded by dense microspines.

**Etymology.** The specific name, *bispina*, is derived from the Latin *bi* (meaning two or double) and *spina* (meaning spine or thorn) in reference to the two thorn-like signa.

**Distribution.** China (Guangdong).
Figures 9–15. Genitalia of *Nagiella* species 9 *N. bortulatoides*: male, genitalia slide no. LXQ18311 10, 13 *N. inferior*: 10 male, genitalia slide no. LXQ18291 13 female, genitalia slide no. XLJ14239 11, 14 *N. quadrimaculalis*: 11 male, genitalia slide no. LXQ18310 14 female, genitalia slide no. LXQ18306 12, 15 *N. bispina* sp. nov.: 12 male, holotype, genitalia slide no. XLJ14011 15 female, para-type, slide no. XLJ14009 15A signa.
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References

Bae YS, Byun BK, Paek MK (2008) Pyralid moths of Korea (Lepidoptera: Pyraloidea). Korea National Arboretum, Samsungad, Seoul, 426 pp.
Butler AG (1878) Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum. Printed by order of the Trustees, London, 62 pp. [20 pls.]
Butler AG (1887) Descriptions of new species of Heterocerous Lepidoptera (Pyrailtes) from the Solomon Islands. Annals and Magazine of Natural History, including Zoology, Botany and Geology, London (ser. 5) 20: 114–124. https://doi.org/10.1080/00222938709460019
Du XC (2009) Spilomelinae. In: Li HH, Ren YD, Zhang DD, Du XC, Li WC, You P (Eds) Insect fauna of Henan (Lepidoptera: Pyraloidea). Science Press, Beijing, 237–305. [359–363, 397–408, 433–440] https://doi.org/10.1080/00305316.2008.10417555
Fabricius JC (1798) Supplementum Entomologiae Systematicae. Proft et Storch, Hafniac. 572 pp. [1–52, emendanda.]
Fan LH, Piao MH (2013) Larval descriptions for four species in the genus Pleuroptya (Lepidoptera: Crambidae: Spilomelinae) from China, with notes on biology, Entomotaxonomia 35(1): 45–52.
Ghesquière J (1942) Catalogues raisonnés de la Faune Entomologique du Congo Belge. Lépidoptères, Microlépidoptères (deuxième partie). Annales du Musée Royal du Congo Belge (Sér. C – Zoologie), Tervuren (sér. 3 (2)) 7(2): 121–240. [pl. 6.]
Hajibabaei M, Janzen DH, Burns JM, Hallwachs W, Hebert PDN (2006) DNA barcodes distinguish species of tropical Lepidoptera. Proceedings of the National Academy of Sciences of the United States of America 4(103): 968–971. https://doi.org/10.1073/pnas.0510466103
Hampson GF (1896) Moths. The Fauna of British India, including Ceylon and Burma, London 4, 594 pp.
Hampson GF (1899) A revision of the moths of the subfamily Pyraustinae and family Pyralidae. Part I. Proceedings of the Zoological Society of London 1898 (4): 590–761. [pls 49–50.]
Hampson GF (1903) The moths of India. Supplementary paper to the volumes in “The fauna of British India.” Series II. Part IX, X. The Journal of the Bombay Natural History Society 15: part IX: 19–37; part X: 206–226. [pl. C.]

Heppner JB (2012) Taiwan Lepidoptera Catalog. Supplement 1 corrections and additions. Lepidoptera Novae 5(1): 1–84.

Hübner J (1823) Zutritte zur Sammlung exotischer Schmettlinge [sic]: bestehend in Bekundigung einzelner Fliegmuster neuer oder rarer nichteuropäischer Gattungen. Augsburg, 1–40. [pls [36]–[69].]

Inoue H (1982) Pyralidae. In: Inoue H et al. (Eds) Moths of Japan. Kodansha, Tokyo, 1: 307–404, 2: 223–254.

Kimura M (1980) A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences. Journal of Molecular Evolution 16: 111–120. https://doi.org/10.1007/BF01731581

Kirpichnikova VA (1987) Obsor roda *Pleuroptya* Meyr. (Lepidoptera, Pyralidae) fauny Dalnego Wostoka. In: Ler PA, Kirpichnikova VA, Kononenko VS (Eds) Lepidoptera of the Soviet Far East. Far East Scientific Centre, Vladivostok, 54–60. [126]

Kirti JS, Sodhi JS (2001) A systematic list of Pyraustinae of northeastern India (Pyralidae: Lepidoptera). Zoos’ Print Journal 16(10): 607–614. https://doi.org/10.11609/JoTT.ZPJ.16.10.607-14

Klima A (1931) Pyralidae: Subfamily: Pyraustinae I. In: Bryk F (Eds) Lepidopterorum Catalogus. Dr. W. Junk, s’ Gravenhage 89: 186–224.

Klima A (1939a) Pyralididae: Subfamily: Pyraustinae II. In: Bryk F (Eds) Lepidopterorum Catalogus. Dr. W. Junk, s’ Gravenhage 94: 225–384. https://doi.org/10.5962/bhl.title.124016

Klima A (1939b) Pyralididae: Subfamily: Pyraustinae I. In: Bryk F (Eds) Lepidopterorum Catalogus. Dr. W. Junk, s’ Gravenhage 89: 3–224. https://doi.org/10.5962/bhl.title.124016

Kollar V, Redtenbacher L (1844) Aufzählung und Beschreibung der von Freiherrn Carl v. Hügel auf seiner Reise durch Kaschmir und das Himaleyagebirge gesammelten Insecten. Hallbergersche Verlagsbuchhandlung, Stuttgart, 395–564.

Kumar S, Stecher G, Tamura K (2016) MEGA7: Molecular Evolutionary Genetics Analysis Version 7.0 for bigger datasets. Molecular Biology and Evolution 33(7): 1870–1874. https://doi.org/10.1093/molbev/msw054

Leraut PJA (1997) Liste systématique et synonymique des Lépidoptères de France, Belgique et Corse (deuxième édition). Alexanor, Paris, supplement: 7–526.

Li HH, Zheng ZM (1996) Methods and techniques of specimens of Microlepidoptera. Journal of Shaanxi Normal University (natural science edition) 24(3): 63–70.

Mally R, Hayden JE., Neinhuis C, Jordal BH, Nuss M (2019) The phylogenetic systematics of Spilomelinae and Pyraustinae (Lepidoptera: Pyraloidea: Crambidae) inferred from DNA and morphology. Senckenberg Gesellschaft fur Naturforschung 77(1): 141–204. https://doi.org/10.26049/ASP77-1-2019-07

Mandal DK, Bhattacharya DP (1980) On the Pyraustinae (Lepidoptera: Pyralidae) from the Andaman, Nicobar and Great Nicobar islands, Indian ocean. Records of the Zoological Survey of India 77: 293–342.

Meyrick E (1890) On the classification of the Pyralidina of the European fauna. Transactions of the Entomological Society of London: 429–492. https://doi.org/10.1111/j.1365-2311.1890.tb02704.x
Moore F (1888) Descriptions of new Indian lepidopterous insects from the collection of the late Mr. W.S. Atkinson. Heterocera (continued) (Pyralidae, Crambidae, Geometridae, Tortricidae, Tineidae). In: Hewitson WC, Moore F (Eds) Descriptions of new Indian Lepidopterous Insects from the Collection of the Late Mr. W.S. Atkinson 3. Asiatic Society of Bengal/ Taylor & Francis, Calcutta / London, 199–299. [pls 6–8.]

Motschulsky VI (1861) Insectes du Japon. Etudes entomologiques, réd. par Victor de Motschulsky, Helsingfors 9: 4–39.

Munroe EG (1976) New genera and species of Pyraustinae (Lepidoptera: Pyralidae), mainly from the collection of the British Museum (Natural History). The Canadian Entomologist 108: 873–884. https://doi.org/10.4039/Ent108873-8

Ratnasingham S, Hebert PDN (2007) BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes 7(3): 355–364. https://doi.org/10.1111/j.1471-8286.2007.01678.x

Rose HS (2002) An inventory of the moth fauna (Lepidoptera) of Jatinga, Assam, India. Zoos’ Print Journal, India 17(2): 707–721. https://doi.org/10.11609/JoTT.ZPJ.17.2.707-21

Sasaki A, Yamanaka H (2013) Spilomelini. In: Nasu Y, Hirowatari T, Kishida Y (Eds) The Standard of Moths in Japan IV. Gakken Education Publishing, Tokyo, 74–84. [415–478.]

Shibuya J (1928) The systematic study on the formosan Pyralidae. Journal of the Faculty of Agriculture, Hokkaido Imperial University 22: 217–229.

Shibuya J (1929) On the known and unrecorded species of the Japanese Pyraustinae (Lepid.). Journal of the Faculty of Agriculture, Hokkaido Imperial Universitym 25: 182–183.

Snellen PCT (1890) A catalogue of the Pyralidina of Sikkim collected by Henry J. Elwes and the late Otto Möller, with notes by H. J. Elwes. Transactions of the Entomological Society of London: 557–647. [pls 19–20.] https://doi.org/10.1111/j.1365-2311.1890.tb03031.x

Stamatakis A, Hoover P, Rougemont J (2008) A rapid bootstrap algorithm for the RAxML Web Servers. Systematic Biology 57: 758–771. https://doi.org/10.1080/10635150802429642

Swinhoe C (1901) New genera and species of Eastern and Australian moths. Annals and Magazine of Natural History, including Zoology, Botany and Geology, London (ser. 6) 14(81): 197–210. https://doi.org/10.1080/00222939408677791

Swinhoe C (1900) Noctuina, Geometrina and Pyralidina. In: Swinhoe C, Walsingham L, Durant JH (Eds) Catalogue of eastern and Australian Lepidoptera Heterocera in the Collection of the Oxford University Museum. Part II. Clarendon Press, Oxford, 540 pp. [pls 1–8.]

Swinhoe C (1901) New genera and species of Eastern and Australian moths. Annals and Magazine of Natural History, including Zoology, Botany and Geology, London (ser. 7) 8: 16–27. https://doi.org/10.1080/03745480109443321

Swinhoe C (1906) New and little-known species of Heterocera from the East. Annals and Magazine of Natural History, including Zoology, Botany and Geology, London (ser. 7) 17: 283–297. [379–383.] https://doi.org/10.1080/00222930608562524

Ullah M, Yang ZF, Qiao PP, Zhang YL (2017) A new cryptic species of Nagiella Munroe from China revealed by DNA barcodes and morphological evidence (Lepidoptera, Crambidae, Spilomelinae). ZooKeys 679: 65–76. https://doi.org/10.3897/zookeys.679.11960

Walker F (1859) Pyralides. List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, London 18: 509–798.
Walker F (1865) Supplement 4. List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, London 34: 1121–1533.

Warren W (1896) New species of Pyralidae from the Khasia Hills. Annals and Magazine of Natural History, including Zoology, Botany and Geology, London (ser. 6) 18: 107–119. [163–177, 214–232.] https://doi.org/10.1080/00222939608680418

Wang HY, Speidel W (2000) Pyraloidea (Pyraloidea, Crambidae). Guide Book to Insects in TaiWan (19). Shu Shan Books, Taipei, 295 pp.

Wang PY (1980) Economic Insect Fauna of China (Lepidoptera: Pyralidae). Science Press, Beijing, 229 pp.

Yoshiyasu Y (1991) New host record and feeding habit Glyphodes quadrimaculalis (Lepidoptera, Pyralidae). Japanese Journal of Entomology 59(4): 1–774.