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Description of the hitherto unknown female of *Napaea joinvilea* (Lepidoptera: Riodinidae: Mesosemiini), with a discussion on its taxonomic status

Fernando Maia Silva Dias, Mirna Martins Casagrande and Olaf Hermann Hendrik Mielke*

Abstract

The hitherto unknown female of *Napaea joinvilea* Hall & Harvey, 2005 (Lepidoptera: Riodinidae: Mesosemiini) is described, and new distribution records for the species—until now only known from a single locality in the state of Santa Catarina, Brazil—are presented, expanding the distribution more than 1.500 kilometers northwards. Diagnosis and description of the female, distinction from similar sympatric species, illustrations of the imagines and male and female genitalia are provided. Special attention is given to distinguish *N. joinvilea* from its sister-species, *N. melampia* (Bates, 1867), a rare species known only from unspecified localities in the state of Bahia, Brazil. Based on the female and the new distributional records, *N. joinviliea* is clearly recognized as a distinct species.

Key Words: *Napaea melampia;* Morphology; Bahia; Paraná; Santa Catarina

Resumo

A fêmea de *Napaea joinvilea* Hall & Harvey, 2005 (Lepidoptera: Riodinidae: Mesosemiini), até agora desconhecida, é descrita, e são fornecidos novos dados distribucionais para esta espécie - atualmente conhecida somente de uma única localidade no estado de Santa Catarina, Brasil, aumentando a distribuição em mais de 1.500 quilômetros na direção Norte. Diagnose e descrição da fêmea, distinção das espécies simpátricas e ilustração dos adultos em vistas ventral e dorsal, e das genitálias de ambos os sexos são fornecidas. Atenção especial é conferida ao distinguir *N. joinvilea* de sua espécie-irmã, *N. melampia* (Bates, 1867), uma espécie rara conhecida somente de localidades não especificadas no estado da Bahia, Brasil. Baseando-se na fêmea e nos novos dados de distribuição, *N. joinvilea* é claramente reconhecida como uma espécie distinta.

Palavras-Chave: *Napaea melampia;* Morfologia; Bahia; Paraná; Santa Catarina

Napaea Hübner, [1819] 2005 (Lepidoptera: Riodinidae: Mesosemiini) is a genus of medium to large 5 forewing radial-veined riodinid butterflies, which contains 15 species distributed throughout most of the Neotropics (Hall 2005). The genus is distinguished by the presence of the third pale bar from wing base in forewing cell CuA_2 proximally displaced in upper half; an isolated spot at the base of the forewing cell R_1; and individual pale spots at costa of dorsal hindwing, above discal cell and vein M_1 (Hall 2005). Males usually perch along streams, hilltops, forest gaps and edges in the late afternoon, usually upside down in tree trunks or epiphytes, with their wings half-open; while females fly slowly at various heights along forest edges, gaps, and secondary growth areas, and only occasionally near the males perching sites (Hall 2005). Both sexes often rest under leaves with their wings spread open (Hall 2005).

Napaea belongs to the recently defined subtribe Napaeina which is part of Mesosemiini and both taxa were determined to be monophyletic by Hall (2003, 2005). Most genera currently in Napaeina were previously considered part of the Eurybiina by Stichel (1910, 1911, 1930, 1931), and were further placed in an *incertae sedis* group based in more comprehensive phylogentic and taxonomic analyses (Harvey 1987; Callaghan & Lamas 2004). *Napaea* and several other related genera belonging to the Napaeina were phylogenetically tested and revised by Hall (2005), who proposed a number of new synonymies and combinations, and described 5 new species for the genus, including *Napaea joinvilea* Hall & Harvey, 2005 (Figs. 1–5, 7–8, 10–13). Even though specimens of many species – and especially females – are rather uncommon in collections, only 2 species of the genus do not have known females: *N. joinvilea* and *N. fratelloi* Hall & Harvey 2005.

Napaea joinvilea was described based on 6 males, the holotype (Fig. 3) and one of the paratypes from the municipality of Joinville, state of Santa Catarina, southeastern Brazil; the remaining 4 paratypes are from unspecified localities in the same state. According to the phylogenetic analysis conducted by Hall (2005), the sister species of *N. joinvilea* is *N. melampia* (Bates, 1867) (Figs. 6, 9), a rare taxa with only 9 known specimens collected in unspecified localities in the state of Bahia, northeastern Brazil (Hall 2005); Stichel (1910, 1911) also indicates the presence of *N. melampia* in the state of Espirito Santo (an unspecified locality), southeastern Brazil. Hall (2005) noted subtle, but significant differences between *N. joinvilea* and *N. melampia*, however, due

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Figs. 1–9. Adults of species of *Napaea* Hübner, [1819]. 1–5. *Napaea joinvilea* Hall & Harvey, 2005. 1–2. Male from São Francisco do Sul, Santa Catarina, Brazil, 1. Dorsal. 2. Ventral. 3. Holotype from Joinville, Santa Catarina, Brazil, dorsal (right) and ventral (left). 4–5. Male from Itacaré, Bahia, Brazil. 4. Dorsal. 5. Ventral. 6. *Napaea melampia* (Bates, 1867), male from "Brazil", dorsal (right) and ventral (left). 7–8. *N. joinvilea,* female from Atami, Pontal do Paraná, Paraná, Brazil. 7. Dorsal. 8. Ventral. 9. *N. melampia,* female from "Bahia", Brazil. Figures 3, 6 and 9 reproduced from Hall (2005). Scale bar = 1 cm.

to the small series of specimens examined to explore the phenotypic variation and the absence of the female of *N. joinvilea*, he stated that is important to find additional specimens from these taxa from another sites to definitively resolve the taxonomic status of *N. joinvilea*. In fact, he was unsure about the true taxonomic status of *N. joinvilea* stating that, given the clear-cut differences observed between nearly all Napaeina species, the description of *N. joinvilea* was "the only subjective species-level taxonomic decision" he had to make while revising the Napaeina (Hall 2005).

The purpose of this paper is to describe the female, to resolve the taxonomic status, and to provide new distributional data for *N. joinvilea* Hall & Harvey 2005.

Materials and Methods

For the study of the genitalia, the abdomens were detached and placed in a test tube with 10% potassium hydroxide solution (KOH). The test tube was heated in bain-marie inside a beaker filled with water for 2–5 minutes. Afterwards, the abdomens were dissected and the genitalia removed. The genitalia were analyzed under a stereomicroscope; illustrations were prepared using a Camera Lucida attached to a stereomicroscope (Wild-Heerbrugg M5). In the drawings, full lines represent sclerotized structures; thin lines, membranous structures; and dotted lines, structures visible through transparency. Adult specimens are pictured in actual size and scale bars are provided for other figures. Higher taxonomy and terminology of the pattern of the wings and structures of the genitalia follow Hall (2005). All specimens studied are deposited at the Coleção Entomológica Pe. Jesus Santiago Moure, Curitiba, Paraná, Brazil (DZUP).

Results

New Distributional Data and the Taxonomic Status of *N. joinvilea*

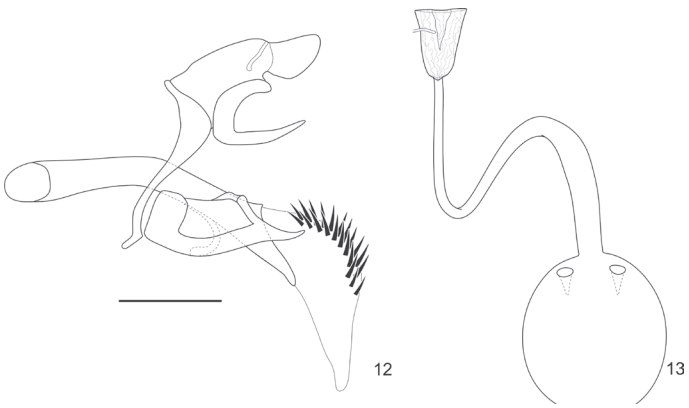
Until now *N. joinvilea* was known only from the municipality of Joinville in the state of Santa Catarina, Brazil. Five new records are presented here: one male, from a municipality close to the type locality in the same state, São Francisco do Sul (26°14'23"S, 48°37'48"W), 20.VIII.1967, Miers *leg*. (voucher number DZ 23.725) (Figs. 1–2); 4 specimens from the coastal plains of the state of Paraná: 2 males from Floresta Estadual do Palmito (25°34.8'S, 48°32.8'W), municipality of Paranguá, 10-

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Figs. 10–11. Head of the female of *Napaea joinvilea* Hall & Harvey, 2005. 10. Anterior view; 11. Ventral view. Scale bar = 0.5 cm.

20m, 25-26.VIII.2014, Leviski, Queiroz-Santos & Santos *leg.* (DZ 31.866, DZ 31896); one female from municipality of Matinhos (25°49'13"S, 48°33'03"W), no date or collector (DZ 24.105), and one female from Atami (25°35'45"S, 48°23'27"), municipality of Pontal do Paraná, 10m, 26-31.XII.2007, O. Mielke *leg*. (DZ 23.865) (Figs. 7–8); and one male, from the coast of the state of Bahia, municipality of Itacaré (14°16'39"S, 38°59'59"W), 8.XII.1979, A. Raw *leg*. (DZ 24.135) (Figs. 4–5). This last record is especially important because it extends the distribution of *N. joinvilea* greatly northwards, and because the state of Bahia is also the type locality of *N. melampia*. This specimen is very similar to the holotype from Santa Catarina, and clearly represents *N. joinvilea*—although the specimen is not identical, it is within the phenotypical variation recorded for the species (Hall 2005). The specimen shows the same differences pointed out by Hall (2005) to distinguish *N. joinvilea* from *N. melampia*, such as the smaller size (16.8mm, smaller even than the specimen from São Francisco do Sul, with forewing length 17,4mm); prominent spots on the wings; forewing with conspicuously convex outer margin and falcate apex; distinct yellowish scales over the veins of the wings ventral side; postdiscal band spots rounded, with spots generally less aligned; inner submarginal band spots elongated and almost continuous; outer submarginal band present on the wings ventral side; and similar male genitalia (Fig. 12). The female appearance is highly distinctive, as described and illustrated above; the female genitalia described and illustrated here (Fig. 13) could not be compared because, even though the female sex is known, the genitalia of *N. melampia* were not examined and illustrated by Hall (2005).



Figs. 12–13. Genitalia of *Napaea joinvilea* Hall & Harvey, 2005. 12. Male, lateral view. 13. Female, dorsal view. Scale bar = 0.25 mm.

Hall (2005) stated that he could not be sure if the above cited characters are significant consistent differences given the relatively limited material he had to examine. He affirmed that the resolution of the taxonomic status only could be resolved examining more specimens from other localities; it was possible that *N. joinvilea* would eventually prove to be a southerly subspecies of *N. melampia*. With the description of the female of *N. joinvilea* and the new records for the species presented here, it is clear that *N. joinvilea* and *N. melampia* are in fact distinct species, as Hall (2005) assumed. However, some questions remain, as the taxonomic and distributional knowledge of *N. melampia* is still scarce. *Napaea melampia* also occurs in the state of Bahia, but all 9 known specimens lack specific localities. It is impossible to know if the 2 species are actually sympatric and/or share the same habitats, especially considering the massive area and diversity of habitats present in the state of Bahia and the apparent restriction of *N. joinvilea* to Brazilian Atlantic coast restingas. The discovery of this restrictiveness is very important for future conservation efforts, especially in view of the human pressure on this habitat all along the Brazilian coast.

Description of the Female of *N. joinvilea* (Figs. 7–8, 10–11, 13)

DIAGNOSIS

Female specimens can positively be paired with their conspecific males by the similarity of the shape of outer margin, markedly convex; the apex, falcate; and the matching pattern of the white spots in both wings. Only 3 similar species of *Napaea* are likely to occur within the range of *N. joinvilea*: *N. zikani* (Stichel, 1923), *N. elisae* (Zikán, 1952) and *N. melampia*. *Napaea joinvilea* can be distinguished from *N. zikani* by the smaller size (see Hall 2005); falcate apex; less developed whitish spots of the basal, discal and postdiscal bands; less undulating and yellowish inner submarginal band; and the presence of yellow scales covering the veins of the wings ventral side. *Napaea joinvilea* can be distinguished from *N. elisae* by the falcate apex, absence or sharp reduction of the forewing outer submarginal band and the yellowish color of the spots in the hindwing outer submarginal band. Finally, *N. joinvilea* can be distinguished from the morphologically similar and phylogenetically close *N. melampia* (Figs. 6, 9) by the smaller size, markedly convex shape of the outer margin, generally more developed and rounder spots, color of the yellow scales of the wings ventral side

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brighter; spots of the inner submarginal band brighter yellowish, wide and elongated instead of thin and v-shaped; and presence of the outer submarginal band on the ventral side of the wings.

HEAD (FIGS. 7–8, 10–11)

Mostly dark brown; vertex with a creamy white band posterior to the chaetosemata and a pair of lateral rounded spots of the same color; frons dark brown with creamy white and yellowish scales along the eye margins, almost reaching the base of the antennae; antenna mostly dark brown, scape mostly white, 2 ventral white spots at the base of the pedicel and most of the flagellomeres, club entirely dark brown, tip yellow; labial palpus slender and long, first and third segments about 4 times shorter than the second segment, mostly yellowish, external part of the second and third segments with dark brown scales distally, third segment tip dark brown.

THORAX (FIGS. 7–8)

Dorsally dark brown with posterior paired lateral rounded creamy white spots in the meso and metathorax; ventrally with creamy white and yellowish scales; legs with mostly creamy white and yellowish scales, tarsomeres of the meso and metalegs with some brown scaling.

WINGS

Forewing, length (18.7mm; n = 2) and shape (Fig. 7). Triangular; costal margin convex; apex pronounced, slightly falcate; outer margin strongly convex; tornus obtuse; inner margin slightly sinuous.

Forewing, dorsal (Fig. 7). Ground color dark brown with whitish spots; basal area with 2 bands: a basal band with a spot at the base of the discal cell and in the Cubitus cell, near the base of the wing; and a distal band with a spot at the middle of the discal cell and in the Cubitus cell; between these bands and the postdiscal band, there is a spot in R_1, and an elongated spot near the discal cell end; discal band with spots in cells R_2, M_1, M_2, CuA_1 and CuA_2; postdiscal band with spots in cells R_3, R_{3+4}, M_1, M_2, M_3, and CuA_1, the former 5 in a clear zig-zag pattern, and 2 fused spots in cell CuA_2, aligned with each other and basal to the CuA_1 spot; inner submarginal band spots more or less positioned as the outline of the outer margin, in cells R_5, M_1, M_2, M_3, CuA_1, CuA_2 and 2A, spot in M_3, CuA_2 and 2A slightly displaced basally, spots in CuA_1 to 2A continuous more or less yellowish; outer submarginal band reduced; white fringe in cells R_5, M_1, M_2, M_3, CuA_1, CuA_2.

Forewing, ventral (Fig. 7). Similar to the dorsal side, but spots larger; veins covered by yellowish scales; outer submarginal band conspicuous, with spots in cells M_3, CuA_1 and CuA_2; spots of the outer and inner submarginal bands in cells M_3, CuA_1 and CuA_2 creamy white or yellowish.

Hindwing, shape (Fig. 8). Rounded; costal margin slightly convex; apex more or less rounded and indistinct; outer margin convex; tornus obtuse; inner margin slightly sinuous.

Hindwing, dorsal (Fig. 8). Ground color dark brown with whitish spots, except where noted; basal area with 2 continuous bands: a basal band with spots at the costal margin, Sc+R, at the base of the discal cell, and in the cubitus, near the base of the wing; and a distal band with spots in the cell Sc+R, at the middle of the discal cell, and the cubitus; between these bands and the postdiscal band, there is an elongated spot near the discal cell end; discal band with spots in cells Sc+R, Rs (reduced), M_1 (reduced), M_2, M_3 (reduced), CuA_1, CuA_2 and 2A; postdiscal band with spots in cells Rs, M_1, M_2, M_3, CuA_1, CuA_2 and 2A, Rs and M_1; spot in M_2 displaced distally, pairs of spots in Rs and M_1, M_3 and CuA_1, and CuA_2 and 2A respectively aligned with each other; inner submarginal band continuous, bright orange and wide, spots more or less positioned as the outline of the outer margin, in cells Rs, M_1, M_2, M_3, CuA_1, CuA_2 and 2A, spot in M_3, CuA_2 and 2A slightly displaced basally; outer submarginal band with yellowish spots in cells M_1, M_2, M_3, CuA_1 and CuA_2; white fringe in cells M_1, M_2, M_3, CuA_1, CuA_2.

Hindwing, ventral (Fig. 8). Similar to the dorsal side, but spots conspicuously larger; veins covered by yellowish scales; spots of the outer and inner submarginal band lighter yellowish.

ABDOMEN (FIGS. 7–8)

Dorsally mostly dark brown, with creamy white scales along the posterior margins of the tergites; pleura dark brown; ventrally mostly creamy white, with dark brown scales along the posterior margins of the sternites.

GENITALIA (FIG. 13)

Bursa copulatrix with corpus bursae rounded, slightly flattened, bearing 2 signa; each signum externally rounded with a spine-like invagination; signa in the same face and posteriorly positioned in the corpus bursae, one in each side of the insertion of the ductus bursae; ductus bursae long, 4 times the length of the corpus bursae, anterior third thicker tapering posteriorly; ostium bursae in an invaginated pouch in an irregularly sclerotized area at the end of the ductus bursae; ductus seminalis dorsally inserted in this sclerotized area; sterigma membranous and irregular; papilla analis triangular in lateral view, membranous and bearing short and thick setae.

HABITS AND HABITAT

One of the female specimens was captured in the municipality of Pontal do Paraná, Paraná, Brazil, by OHHM, flying about 2 meters from the ground in the late afternoon, in a 10m tall forest. Observing other specimens with reliable locality data, the species apparently inhabits the Brazilian Atlantic coast restingas, a vegetation characterized by sandy and nutrient-impoverished soils frequently associated with low-elevation plains, beach ridges and lagoons; the vegetation varies from shrubs to 15m tall trees (Lacerda et al. 1984).

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