NOTES ON THE SUBGENUS *PENICILLONAROSA* Strand, 1916
(LEPIDOPTERA, LIMACODIDAE)

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Penicillonarosa Strand, 1916 is a small subgenus of the genus *Narosa* Walker, 1855 ranging in Indo-Malaya region. It was erected by monotypy for the species *Narosa* (*Penicillonarosa*) penicillata Strand, 1916 and considered earlier that this subgenus is monotypical and includes only *nigrisigna* with the following synonyms: *penicillata* Strand, 1916, *formosana* Matsumura, 1931, *ochracea* Hering, 1931 (Solovyev & Witt, 2009), but two different forms can be recognized, the yellow one (*ochracea*) and the grey one (*nigrisigna*, = *penicillata*, = *formosana*). The systematic status of both forms was not evident, usually they were considered as two species, viz. *ochracea* and *nigrisigna* (Wu, Fang, 2009), but large sympatric area of both forms, almost identical phenological periods, similar wing pattern, male and female genitalia cause establishing of synonymy of all associated specific names. The present paper devotes to revelation of the status of the mentioned forms.

I. MATERIAL AND METHODS

The materials from the following collections are the basis for this study (with abbreviations given in the text): Museum Witt, Munich, Germany (MWM); collection of Alexey V. Solovyev, Ulyanovsk, Russia (CAS); Natural History Museum, London (United Kingdom) (BMNH); Deutsches entomologisches Institut im Zalf, Müncheberg, Germany (DEI); Hokkaido University, Sapporo, Japan (EIHU); Zoologisches Museum der Humboldt Universität zu Berlin, Germany (ZMHB). The data on distribution of the taxa in China see Wu & Fang (2009).

The material for DNA analysis was collected during our joint expeditions to Vietnam in 2008. The sequences were received from the Biodiversity Institute of Ontario in the network of the general project BOLD: Barcode of Life Data System (project LIMBC-DNA Barcoding Limacodidae moths). The sequences of 16 specimens were used in this paper including 10 specimens of the subgenus *Penicillonarosa* and 6 specimens of the “*Narosa*-group: *Flavinarosa alius* Solovyev et Witt, 2009, *F. glaesa* Solovyev et Witt, 2009, *Narosa (?) erminea* Hampson, 1895, *Quasinarosa fulgens* (Leech, 1888), *Tennya propolia* (Hampson, 1900) and *Caelestomorpha albiceris* Solovyev et Witt, 2009. The collection and BOLD numbers of specimens are given on the Fig. 4. The barcode marker was cytochrome oxidase subunit 1 (COI) with length 658 b.p. The sequences were aligned using BOLD. The obtained sequences include 128 parsimony informative and 181 variable sites.

The molecular phylogeny analysis was carried out using Mega 4 (http://www.mega-software.net) based on Neighbor-Joining (NJ) with the following settings: Gaps/Missing Data-Complete Deletion; Model-Nucleotide: Maximum Composite Likelihood; Substitutions of Include: d: Transitions + Transversions; Pattern among Lineages: Same (Homogenous); Rates among sites: Uniform rates) (Saitou, Nei, 1987; Tamura et al., 2007). The bootstrap values supporting nodes were obtained with 10000 replications. The topology at the branch is considered “correct” if the bootstrap value for a node is 95% or higher (Nei, Kumar, 2000; Hovenkamp, 2005; Müller, 2005).

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II. RESULTS AND DISCUSSION

Both taxa of *Penicillonarosa*, of yellow and grey ground colours, are characterized with very similar forewing pattern. Their wing pattern is speckled, with darker, usually not well defined transverse fasciae and characteristic dark fasciae running approximately from 3/4 costa to the vein M3 towards the tornus (Fig. 1). The grey-coloured taxon usually has poorly defined wing pattern excepting well recognizable dark fascia running from 3/4 of costa. The ground colour of the body and the wings are grey or yellow. The male antennae are filiform. The wing venation is typical for other “Narosa”-group species and genera (Solovyev & Witt, 2009). The vein R1 in the forewing is strongly curved proximally; the medial stem is not dichotomic divided; the vein R5 is branched from R3+R4.

The male genitalia of both taxa are weakly modified (Fig. 2). The uncus is slender, bears an apical spur. The gnathos is slender. The valvae are elongated, without saccular processes. The juxta is flattened. The saccus is semicircle, wide. The aedeagus is longer than 1.5 of the valva length, slightly curved. The vesica bears a row of claw-shaped, basally disc-shaped cornuti; the size of cornuti is gradually decreased in a row caudally in everted vesica. The number of cornuti is not constant, from 4 to 12, but it slightly depends on the ground colour of the specimens. The grey specimens usually have 4–8 cornuti in vesica and the yellow ones 6–12 (Fig. 3).

The female genitalia have ovoid ovipositor lobes and slender anterior and posterior apophyses. The ductus bursae is long, spiral. The corpus bursae is rounded, bears a large ovoid field of stellate signa. The strongly differences between both, grey and yellow taxa, in female genitalia are not found.

The grey and yellow taxa are similar distributed through Indo-Malaya and known sympatrically in some locations, but the yellow taxon is more widely distributed and never found in Taiwan and in the several provinces of China. The grey taxon does not known from eastern India, several provinces in China, Thailand, southern Vietnam, Sumatra and Malaysia. The sympatric area of both taxa includes northern Vietnam, eastern and southern China.

The phenological periods of both taxa are almost the same and the flight periods fall on April - August, late September - mid October, but the yellow specimens were also collected in mid November (in Thailand), and mid December (in southern Vietnam).

The reconstruction of phylogeny between both taxa based on the DNA analysis is shown on Fig. 4. All specimens of *Penicillonarosa* form a monophyletic clade with 99% bootstrap values, but it is divided on two clusters of yellow and grey taxa supported by high values of bootstrap (99% and 96% correspondingly). The specimens collected in the same date and exact locality, depending from the ground colour, belong to different clusters (the specimens collected in the same locality and almost in the same date are marked by asterixes).

Thus, taking into account the differences in the ground colour of the body and the wings of *Penicillonarosa* specimens, the numbers of cornuti in the vesica of the aedeagus depending on the ground colour, their distributions, and molecular analysis where the specimens of both taxa form their own clusters, the mentioned yellow and grey taxa corresponding to 2 species: *nigrisigna* and *ochracea*, which are resynonimized here. Their annotated check list is given below.

*Narosa (Penicillonarosa) nigrisigna* Wileman, 1911

**References**


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**Legends to plates**

*Figure 1:* External view of *Narosa* (Penicillonarosa) sp. (Vietnam, Bao Loc, Rung Cat Tien, in MWM)

*Figure 2:* Male genitalia of *Narosa* (Penicillonarosa) nigrisigna (Vietnam, Me Linh, in CAS, slide 0070). Abbreviation: crn - cornuti in vesica of aedeagus

*Figure 3:* Diagram of a number of cornuti of *Narosa* (Penicillonarosa) spp., black columns correspond to ochracea (30 specimens examined); white columns with black hatching - nigrisigna (22 specimens examined).
Figure 4: Dendrogram obtaining after molecular analysis; bootstrap values are given left to the nodes; the localities of specimens, ground colour of their wings and number of cornuti in aedeagus vesica are given in columns; the identical localities are marked by the same number of asterices

Figures 5: Distribution maps of Narosa nigrisigna (Penicillonarosa)
Figures 6: Distribution maps of Narosa ochracea (Penicillonarosa)
Abbreviation: TL – type locality