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Two new species of Naarda Walker, 1866 from Southeast Asia (Lepidoptera: Erebidae, Hypeninae)

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Abstract – Two new species of *Naarda* Walker, 1866 (Lepidoptera: Erebidae: Hypeninae), *N. merkli* sp. n. from Sulawesi and *N. vojnitsi* sp. n. from Vietnam are described. The former species is closely related to *N. bisignata* Walker, 1866, the type species of the genus, while the latter one is similar in facies to several congeners, but its genitalia are remarkably different from all known *Naarda* species. An identification key is given, for the first time, to the straw-coloured *Naarda* species.

Key words – identification key, Oriental Region, Sulawesi, undescribed taxa, Vietnam, Wallacea

INTRODUCTION

Naarda Walker, 1866 (Lepidoptera: Erebidae: Hypeninae) (type species: *Naarda bisignata* Walker, 1866) is a tropical-subtropical genus, distributed mainly in the Afrotropical and Oriental Regions, but some species occur also in the Palaearctic Region and Australia (both: Pacific coasts). The genus was erected for one Asian species (Walker 1866), while the current total number of known taxa exceeds 115. Significant contributions to the knowledge on the genus include Holloway (2008), Poole (1989), Tóth & Ronkay (2014*a*, *b*, 2015*a*, *b*, *c*), Tóth (2018) (Asia) and finally Hacker (2021) (Africa).

This paper presents the descriptions of two new species. The aim of this paper is also to publish an identification key to the genus *Naarda* for the first time, due to the constantly rising number of externally similar known Asian species with pale beige wings, which are strikingly different from the majority of the species in the genus with dark greyish or brownish wings.

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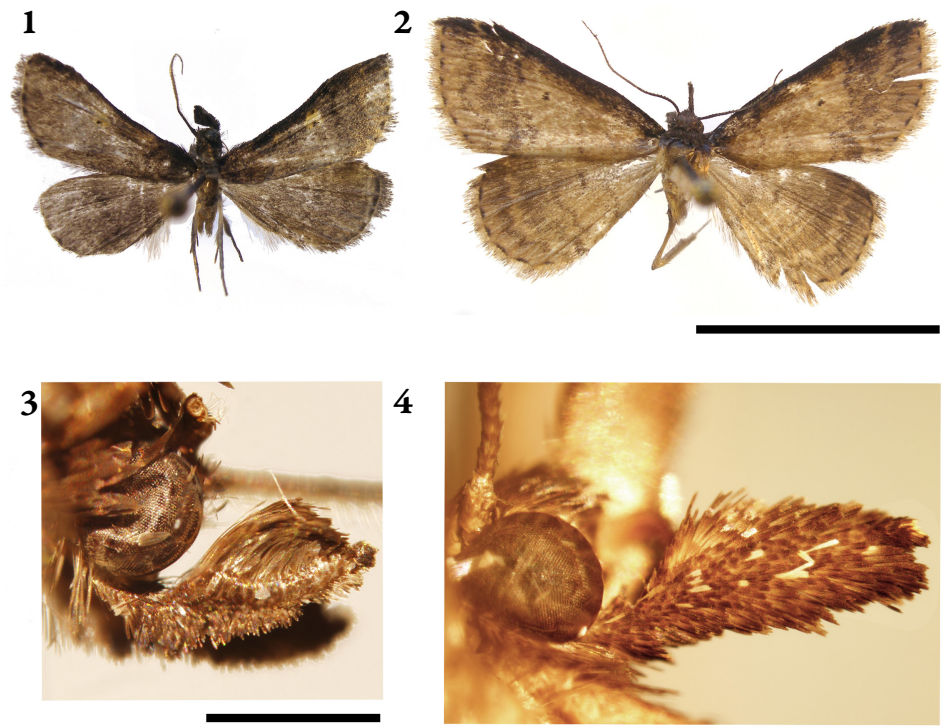
MATERIAL AND METHODS

Pinned, set and labelled specimens were studied. Genitalia dissections were performed by the traditional method (Winter 2000), permanent microscopic slides were prepared. All specimens are deposited in HNHM. Images were taken at the Lepidoptera Collection of the Hungarian Natural History Museum, Budapest (HNHM). Adults were photographed with OLYMPUS Camedia C 7070 camera, head and genitalia with Olympus SZX12 photographic microscope and its softwares DPController and DPManager. Three images of the head were taken for each species, Adobe Photoshop CS6 was used for stacking these to composite images and adjusting all other photographs. Label data are provided verbatim, a vertical line (|) is used to separate lines of a label.



Figs 1–4. External morphology of *Naarda* spp.: 1 = adult of *N. merkli* sp. n. holotype in dorsal view, 2 = adult of *N. vojnitsi* sp. n. holotype in dorsal view, 3 = head of *N. merkli* sp. n., lateral view, 4 = head of *N. vojnitsi* sp. n., lateral view. Scale bar to Figs 1–2 = 10 mm, to Figs 3–4 = 1 mm (photos by Balázs Tóth)

RESULTS AND DISCUSSION

Description of new species

***Naarda merkli* sp. n.**
(Figs 1, 3, 5)

Type material – Holotype: male, "Prov. SULAWESI SELAT Indonesia | BANTIMURUNG, 40 km NE Ujung Padang | 4°36' südl. Breite; 119°49' ostl. L. | Bergpass-Südhang 390 m, Urwald auf Kalk | leg. A. SCHINTLMEISTER 6/7.V.1984", slide No. TB2152m (coll. HNHM).

Diagnosis – *Naarda merkli* sp. n. differs from *N. bisignata* primarily in the shape and size of the costa in the male clasping apparatus. While in the new species the costa is much longer than the cucullus due to a large costal process extending well beyond the tip of sacculus, in *N. bisignata* the costa is as long as the cucullus, it has only a tiny, triangular apical lobe, and the tip of costa is as far from the base of valva as the tip of sacculus. A further difference can be observed at the tip of sacculus: in *N. merkli* sp. n. the valva is abruptly tapering in that section, while the valva of *N. bisignata* is only very slightly and gradually tapering there. The two species can be distinguished also by wing pattern: the orbicular stigma of *N. merkli* sp. n. is less elongated than that of *N. bisignata* and contains two dots, while there is only one lower dot in the stigma of the latter species. Moreover, the subterminal line of the new species is evenly broad, and it lacks the broadened section of this line in *N. bisignata*.

Although the male genitalia of *N. merkli* sp. n. are particularly similar to those of an undescribed *Naarda* species from Seram (slide No. BM Noct. 20085), significant differences can be observed in the costa: in *N. merkli* sp. n. this is longer and much narrower than in the undescribed species and, in addition, it has a large terminal process while the undescribed species does not have any costal process.

Description – Male (Fig. 1): Wingspan 15 mm, forewing length 8 mm. Antennae filiform, on ventral side ciliate and setose, two setae per segment, setae 2.5 times longer than diameter of flagellum, cilia arranged to three rows per segment, length of cilia twice the diameter of flagellum. Labial palps (Fig. 3) 2.5 times longer than diameter of eye, 2nd segment minutely curved upwards, rounded triangular in shape, twice longer than broad; 3rd segment small but visible. Scale-hood of vertex cannot be characterised due to being much worn. Head, thorax and abdomen dark grey in colour. Tibia of 2nd leg densely haired, supposedly being a scent organ.

Costa of forewing concave, deepest at reniform stigma, base of forewing with a costal flap; ground colour of wing dark grey like that of body; antemedial, medial and postmedial lines relatively broad, black, slightly sinuous, postmedial

line with a shallow protrusion towards reniform stigma, subterminal line grey in colour, slightly lighter than ground colour of wing, jagged, terminal line black, broad, fragmented to elongated section between veins, fringe worn, dark grey in colour; orbicular and reniform stigmata bright yellow, conspicuous, orbicular stigma round, reniform ovoid, nearly as broad as long, with two black dots inside, on the longitudinal axis of the stigma, lower dot slightly larger than the upper one. Hindwing dark grey in colour as forewing, discal spot tiny, slightly darker than ground colour of wing; transverse lines hardly visible, medial and postmedial lines blackish, subterminal line indistinct, terminal line conspicuous, like that of forewing, ground colour of fringe like that of wing.

Male genitalia (Fig. 5): Uncus long, slightly curved except for the strongly curved basal quarter, tip of uncus with a tiny hook. Scaphium slightly shorter than uncus, curved ventrally, being nearly parallel with ventral edge of uncus. Tegumen as long as vinculum, the latter being stronger than the former, saccus medium long, with parallel edges and rounded tip, juxta deltoid-shaped, ventro-medial tip obtusely, dorso-medial tip acutely angled. Valva relatively narrow and long, basal third with parallel edges, proximal half of remaining section very abruptly tapering on ventral edge beyond tip of sacculus, most distal section of valva entirely made up by the narrow cucullus having parallel edges and rounded tip; sacculus narrow, slightly more than half as long as valva, edge slightly undulated near tip, costa domed, its dorsal edge slightly undulated at mid-section, costal process present, twice as long as broad at base, gradually tapering to a rounded tip, dorsal edge of distal section minutely dentate, the process fused to the dorsal edge in the basal half of cucullus. Aedeagus straight, stout, only 2.5 times longer than broad, vesica globular, smooth, with a huge cornutus being gradually tapering towards its pointed tip, slightly wavy at basal two-thirds and strongly curved at apical third; apex slightly protruding from aedeagus in uneverted state.

Female: Unknown.

Comments – This species is the morphologically closest known relative of *N. bisignata*, the type species of the genus, due to the shape of the costa in the male clasping apparatus and the cornutus in the aedeagus. *Naarda merkli* sp. n. is also very similar to a still undescribed taxon from Seram reported by Holloway (2008) (slide No. BM Noct. 20085) but the shape of the costa in the male clasping apparatus is different (see Diagnosis for details).

Distribution and bionomics – Only the holotype is known, which was collected on Sulawesi, in Bantimurung area, in a rainforest on limestone bedrock, on the southern slope of a pass, 390 m a.s.l.

Etymology – This species is dedicated to the late Ottó Merkl (1957–2021), a renowned specialist of Tenebrionidae (Coleoptera), a former colleague of the author and editor of *Folia entomologica hungarica*.

Figs 5–6. Genitalia of *Naarda* spp.: 5 = male genitalia of *N. merkli* sp. n. holotype (clasping apparatus left, aedeagus right) in ventral view, 6 = female genitalia of *N. vojnitsi* sp. n. holotype in ventro-lateral view. Scale bar = 1 mm (photos by Balázs Tóth)

Naarda vojnitsi sp. n.
(Figs 2, 4, 6)

Type material – Holotype: female, "VIETNAM, No. 46 Tam Dao | 1200 m, 1986.X.13. Collected on | light at the Hotel | leg. F. Mészáros, J. Oláh | & T. Vásárhelyi"; slide No. TB836f (coll. HNHM). – Paratypes: 1 female, "VIETNAM, No. 60, Tam Dao, | 1200m, 1986.X.15. Collected at | light, leg. F. Mészáros, J. Oláh, | & T. Vásárhelyi"; slide No. TB2005f (coll. HNHM); 1 female, "VIETNAM, No. 46 | Da Lat, 17.X.1988. | Collected at light in the | Institute, leg. S. Mahunka | & T. Vásárhelyi"; slide No. TB670f (coll. HNHM).

Diagnosis – *Naarda vojnitsi* sp. n. is externally similar to a series of *Naarda* species due to the straw-coloured wings; the specific differences are summarised in a key (see below). The new species is most similar externally to *N. capreola* Tóth et Ronkay, 2015 and *N. straminea* Tóth, 2018, but the forewing is more elongated, the reniform and orbicular stigmata are paler, the postmedial line is less jagged and the marginal field is darker in this new species than in the two other mentioned species, the tornal patch of the latter species is absent in the new taxon, and the average size of *N. vojnitsi* sp. n. is larger than *N. capreola* and *N. straminea*. The female genitalia are particularly different from those of other straw-coloured *Naarda* species due to the elongated ductus bursae and the narrow corpus bursae.

Description – Female (Fig. 2): Wingspan 21–23 mm, forewing length 10–11 mm. Antennae filiform and sparsely ciliate, cilia one-third as long as diameter of flagellum. Labial palps (Fig. 4) dark brown in colour, three times longer than diameter of eye, ventral margin of 2nd segment straight, shape of segment slightly tapering towards apex; 3rd segment tiny, almost entirely covered by the scales of 2nd segment, only its light tip remaining visible. Scale-hood of vertex broad-based, short, rounded in shape and dark brown in colour. Pronotum dark brown like head, anterior edge of mesonotum and base of patagium dark brown, remaining parts of thorax pale beige (i.e. straw-coloured), abdomen straw-coloured.

Forewing elongate in shape, its ground colour straw-coloured like abdomen and posterior half of thorax, costa dark brown from base to apex of wing; antemedial, medial and postmedial lines slightly jagged, very narrow, greyish, the former two hardly visible, postmedial line more conspicuous, subterminal line straw-coloured like ground colour of wings, accompanied by a narrow, greyish fascia on distal side, area between postmedial and subterminal lines grey, subterminal nearly exactly parallel with postmedial, terminal line fragmented to black sections between ends of veins, fringe slightly lighter than wing, with small diffuse greyish spots at ends of veins; orbicular stigma indistinct, reniform stigma hardly visible, its ground colour minutely lighter than that of forewing, upper tip of stigma marked by a small, lower tip by a large black dot, the stigma slightly curved in shape. Ground colour of hindwing like that of forewing, discal spot grey, narrow and slightly curved in shape, conspicuous, antemedial line absent, medial line greyish, somewhat diffuse, postmedial line grey, slightly curved, subterminal line broad, straw-coloured like ground colour of wing, parallel with outer margin (i.e. not parallel with postmedial line), evenly jagged on veins, bordered by a narrow grey fascia on distal side, area between postmedial and subterminal lines grey, pattern and colouration of terminal line and fringe like those of forewing.

Female genitalia (Fig. 6): Papillae anales angular, square, pseudopapillae tiny; apophyses posteriores as long as apophyses anteriores; sternum A8 with two large, rounded lobes ca. as broad as long, its whole surface densely scobinate, sinus narrow, slightly tapering, ca 3/5 as long as with of sternum; ductus bursae long,

slightly curved, slightly broader at antrum than remaining section, colliculum as long as ductus bursae, covering half of its surface at posterior section, evenly tapering anteriorly to a rounded tip; corpus bursae as long as ductus bursae, composed of two sections with equal length, posterior half narrow, tubular, anterior half rounded, pyriform, both sections weak, sparsely scobinate; cervix present, attached close to the mouth of ductus bursae.

Male: Unknown.

Comments – Among several similar species, *N. capreola* from Cambodia is known only by male specimens. As the type locality of that species is situated only ca. 150 km from one of the collecting sites of *N. vojnitsi* sp. n., the possible match of the females from Vietnam with the males from Cambodia to the same species was studied. It was found that (1) the Vietnamese females were not only considerably larger than *N. capreola*, but the shape and pattern of forewings also had significant differences (see Diagnosis), and (2) the aedeagus and vesica of *N. capreola* did not match with the ductus bursae and corpus bursae of *N. vojnitsi* sp. n., respectively. These differences exceeded the observed and expected scale of sexual dimorphism in the genus. Therefore, the specimens from Vietnam are considered to represent a new, hitherto unknown species, which is described here.

Distribution and bionomy – Known only from Vietnam, but found in the northern (Tam Đảo) as well as in the southern (Đà Lạt) part of the country. All specimens were collected between 1200 and 2000 m at light in mid-October.

Etymology – This species is dedicated to the late András Vojnits (1941–2021), a specialist of the tribe Eupitheciini (Lepidoptera: Geometridae), a former lead curator of the Lepidoptera Collection of HNHM.

Key to the straw-coloured (pale beige) species of the genus *Naarda* from the Oriental Region

1 Hindwing with dark posterior field sharply separated by a transverse line 2
– Posterior area of hindwing only slightly darker than rest of the wing or even with the same ground colour 7
2 Hindwing dark only between subterminal and terminal lines; male genitalia with narrow and short free section of cucullus, and short costal process nearly as long as cucullus. Borneo ..... *N. marginata* Holloway, 2008
– Hindwing dark distally from postmedial line 3
3 Forewing with a conspicuous dark patch in marginal field, between veins M3 and Cu1; male genitalia with acute valva. Borneo ..... *N. acolutha* Holloway, 2008
– Forewing without dark patch in marginal field between veins M3 and Cu1 4
4 Tornal patch (i.e. dark area under Cu1) present; antenna of male pectinate; male genitalia with a narrow, pointed saccular terminal process. Sri Lanka ..... *N. fuscicosta* (Hampson, 1891)
– Tornal patch absent, male antenna filiform 5

5 Forewing as bicolorous as hindwing, dark patch absent from bases of veins M1–M3; male genitalia with conspicuous costal lobe, aedeagus slightly curved; female genitalia with ovoid, smooth corpus bursae. Cambodia ..... *N. bicolora* Tóth et Ronkay, 2015
– Distal area of forewing much lighter than that of hindwing, dark patch present at bases of veins M1–M3 6
6 Costa as dark as the patch at bases of veins M1–M3; transverse lines slightly jagged; male genitalia with rounded valva. S China, Thailand, India ..... *N. lancanga* Deng et Han, 2011
– Costa lighter than the patch at bases of veins M1–M3; subterminal line strongly jagged .... several undescribed taxa
7 Tornal patch (i.e. dark area under Cu1) absent 8
– Tornal patch present 9
8 Reniform and orbicular stigmata dark brown, costa with very narrow dark area. Sri Lanka . ..... *N. umbria* (Hampson, 1902)
– Reniform and orbicular stigmata pale beige, costa with broad dark brown stripe. Vietnam .. .. *N. vojnitsi* sp. n.
9 Vertex conspicuously lighter than pronotum; labial palps four times longer than diameter of eye:; male genitalia with narrow cucullus, tip of sacculus fused to a large harpe; female genitalia with broad ductus bursae and small corpus bursae with a globular cervix at posterior part. Philippines ..... *N. vicina* Tóth et Ronkay, 2015
– Vertex as dark brown as pronotum; labial palps three times longer than diameter of eye 10
10 Tornal patch brownish, as broad as long; distal half of hindwing slightly browner than rest of wing, without grey suffusion; male antenna pectinate; male genitalia with narrow and pointed saccular process. Sri Lanka ..... *N. fuscicosta* (Hampson, 1891)
– Tornal patch grey, elongated; distal half of hindwing with grey suffusion; male genitalia with broad-based saccular process 11
11 Grey suffusion of hindwing sparse, only slightly darker than rest of the wing; male antenna pectinate; male genitalia: distal half of costa strongly broadened and a triangular lobe emerging below costa at mid-section of valva; female genitalia with broad ductus bursae and posteriorly scobinate corpus bursae having a large signum field at anterior tip. Thailand .... *N. straminea* Tóth, 2018
– Grey suffusion of hindwing conspicuous; male antenna filiform; male genitalia with only a small lobe at distal half of costa, sub-costal lobe absent; female genitalia unknown. Cambodia ..... *N. capreola* Tóth et Ronkay, 2015

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