

MORPHOLOGY AND GENITALIA CHARACTERS OF *Nadrana* Baly, 1865 (COLEOPTERA: CHRYSOMELIDAE: GALERUCINAE) FROM SUNDALAND

ZULFADLI, M.^{1,2*}, IZFA, R.H.³ and ALIA, R.A.³

¹Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM) Perak, Tapah Campus, 35400 Tapah Road, Perak, Malaysia

²Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, Malaysia

³School of Environmental Science and Natural Resources, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

*Email: zulfa2015@perak.uitm.edu.my

ABSTRACT

Taxonomic study of genus *Nadrana* (Coleoptera: Chrysomelidae: Galerucinae) was carried out using 159 specimens from the existing collections in the Centre for Insect Systematics (CIS), UKM and other repositories namely The Natural History Museum, London (BMNH), Collection of Jan Bezdik, Bruno (CJB) and Swedish Museum of Natural History Stockholm (NHRS). From this study, the total of seven species listed in the genus remained, and became valid species within the arrangement of the genus. There was no major difference in the total body size, antenna, elytra and pronotum for all species; only colour variations were detected in those species. The genitalic characters particularly for each species consistently characterized within the species in the genus, and presented for the first time in such publication. A total of seven valid species of *Nadrana*, and their redescription of morphological characters, as well genitalic characters and distribution are presented. This study proved that all species remained under this genus and need not to be transferred to any other genus; thus answering the question from Wilcox (1973) about the taxonomic status of *Nadrana*.

Key words: Galerucinae, *Nadrana*, Sundaland, genitalia, identification key, taxonomy

INTRODUCTION

Galerucinae with elongated basi-metatarsus and without significant depression on the pronotum has been classified to a group called “Monoleptites”. Wilcox (1973) has commented about the uncertainty classification of most genera in Monoleptites, as he wrote delimitation of genera in this group and suggesting that the assignment of the species into genera needs revision. The present classification of *Monolepta*, *Luperodes*, *Candezea* and many other genera in this group is most unsatisfactory where genera have not been adequately delimited; type species of many genera have not been considered in placing new species even when a type had been designated. Consequently, with further study, many species will be transferred to genera other than the one in which they are now placed (Wilcox, 1973).

The genus *Nadrana* was established by Baly (1865), who described about the genus *Arcastes* at

the same time. Baly (1865) has assigned *N. pallidicornis* as genotype for this genus and later Chapuis (1875) mentioned this genus in his publication. Subsequent author like Jacoby (1897) mentioned about the similarity between *Nadrana* and *Batusia*, where *B. raapi* Jacoby (1897) genotyped to the genus *Batusia* as monotypy. In the 1st Edition of *Catalogue of the Galerucines*, Weise (1924) has mentioned that *Batusia* was junior homonym for *Nadrana* and later transferred *B. raapi* Jacoby, 1897 to *N. raapi* (Jacoby, 1897).

Since the introduction of this genus, several authors have described a few species under this genus. For example Bryant (*N. brunnea* Bryant, 1954), Laboissiere (*N. facialis* Laboissiere, 1936 and *N. rugipennis* Laboissiere, 1936), Mohamedsaid (*N. cyanipennis* Mohamedsaid, 1998; *N. dwiwarna* Mohamedsaid, 1998; *N. danumensis* Mohamedsaid, 2000 and *N. warisan* Mohamedsaid, 2001) and Baly (*N. bella* Baly, 1886), in which later synonymised with *Metroideaapicalis* Jacoby, 1884. Other than describing new species, Laboissiere (1936) also has

* To whom correspondence should be addressed.

transferred *Monolepta marginata* (Jacoby, 1884) to *N. marginata* (Jacoby, 1884).

Despite using morphological characters as one of the taxonomic character, the structure of genitalia also will be emphasized in this study. Characters used for generic delimitation, such as open prothoracic coxal cavities or relative length of the basimetatarsus, differ significantly in several taxa and are not useful to characterize monophyletic groups. Only the genitalic structures of both sexes allow a reliable delimitation and identification of such monophyla, ie. genera (Wagner, 2003). The two objectives of this study were to study the taxonomic status based on morphology and genitalia characters; and to determine the species limit, provide a checklist and geographic distribution for all species of *Nadrana* Baly, 1865 from Sundaland.

MATERIALS AND METHODS

A standard set of figures is given for each species. These include the photo of the habitus with dorsal view and antennomeres of each species, dorsal and lateral view of the median lobe including the endophallic structures, ventral view of median lobe without endophallic structure, spermathecae of female (if available) and bursa-sclerites (if available) usually of one female are figured.

Measurements were made for external characters. Absolute measurements are total length from the clypeus to apex of the elytron, length of the elytron, maximal width of both elytra (usually in the middle or posterior third of the elytra), and width of the pronotum. Relative measurements are length to width of the pronotum, maximal width of both elytra to length of the elytron, length of the second to third antennomeres, and length of the third to fourth antennomeres. A number of specimens measured are given in the description under "total length". Further materials examined are listed, and all label data are exactly rewritten.

For location data, geographical coordinates were given in degrees and minutes. These coordinates were mostly taken from Google Earth.

RESULTS AND DISCUSSION

Nadrana pallidicornis Baly, 1865

Total length. 8.20–9.48 mm (mean: 8.94; n = 10)

Head. Black. Finely punctuated, with significant transverse impression between posterior third of eyes. Eyes large, strongly convex. Antennae elongated, extended to apical third of elytra; third to terminal antennomere densely covered by bristle-like setae. First and second antennomeres black,

third to eleventh antennomeres light yellow. First antennomere club-shaped, second shortest, third antennomere about two times longer than second; ratio length of second to third antennomere 0.63–0.83 mm (mean: 0.71); ratio length of third to fourth antennomeres 0.40–0.56 mm (mean: 0.48); fourth to eleventh antennomeres much longer, even and slenderer (Fig. 1).

Thorax. Pronotum transverse, broad, broadest in the middle part, anterior angle significantly protruding, pronotum with deeply impressed line along lateral margins. Black as head, shiny, smooth, finely punctuated and without transverse depression. Pronotal width 2.40–2.92 mm (mean: 2.71), ratio length to width 0.43–0.50 mm (mean: 0.46). Scutellum large, triangular, impunctate, black. Elytra elongated, black throughout each elytron. Elytra shiny, punctation fine, slightly coarser and denser compared to pronotum. Elytra length 6.40–7.92 mm (mean: 7.14), maximum width for both elytron 4.60–5.52 mm (mean: 5.17), ratio of maximum width of both elytron together to length of elytra 0.61–0.84 mm (mean: 0.73). Legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus black throughout, with dense and fine setae.

Abdomen. Sternite black. Last visible sternite in females rounded at apex, and in males with two deep, parallel-sided incisions (Fig. 2).

Male genitalia. The outer shape of median lobe is symmetry, strongly sclerotized, anterior tapered, rounded and not incised. Orifice wide, almost rounded or circular. Endophallic structures symmetrically arranged, median endophallic spiculae with filamentous shaped, originated and elongated from basal endophallic structure. Only one basal endophallic structure present. Tactum enlarged at posterior, slightly constricted at middle part, rounded at anterior part and almost reaching apex of the median lobe.

Female genitalia. Spermatheca with oval to slender and elongated nodulus. Middlepart long and slightly curved, cornu long and curved. Without sclerotized bursa sclerites (Fig. 3).

Distribution. The species are restricted to Sundaland area and up to now they are only recorded from Peninsular of Malaysia (Pahang, Johor, Terengganu and Negeri Sembilan) and Sumatra, Indonesia.

Diagnosis. *Nadrana pallidicornis* the largest species with total length 8.20–9.48 mm (mean: 8.94), and has distinct colour on dorsal surface compared to other species in this genus. All parts including head, thorax and abdomen are black. This characteristic which is called uni-colour is also belongs to *N. cyanipennis* and *N. warisan* as well. *N. pallidicornis* also can be further differentiated

from others by looking at the black colouration on the first and second antennomere, whereas the third up to eleventh antenemere are light yellow.

The male and female genitalia structures are absolutely different. The median lobe is symmetrically arranged and has filamentous shaped median spiculae that originated from basal endophallic structure. Tactum enlarged at posterior and tapered towards anterior. *N. pallidicornis* has genitalic structure that almost similar to *N. kedenburgi*. Like other species, spermathecae structure is same by having elongated nodulus, middle part long and slightly curved, cornu long and curved.

According to Mohamedsaid (2004), distribution of *N. pallidicornis* restricted to Peninsular of Malaysia, however from the available specimen it is also found in Sumatra, Indonesia.

Type material. Syntype. *Malaysia*. 1 ex., Tringanee, 1865, Baly Coll. (BMNH).

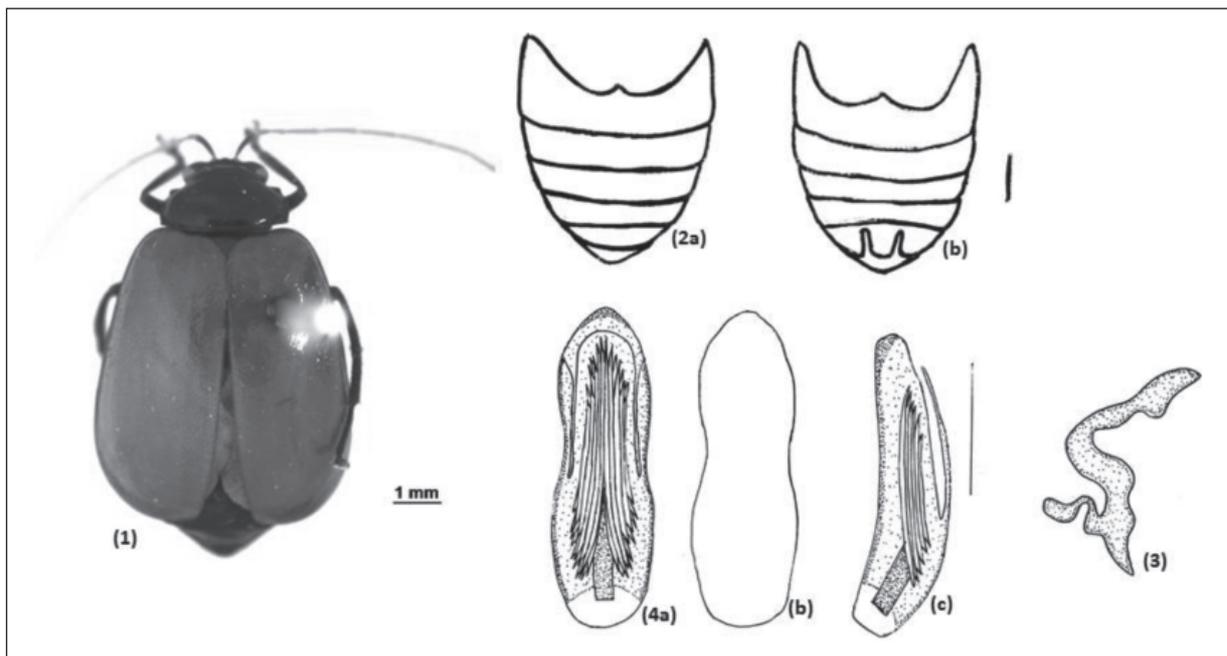
Further material examined. *Malaysia*. 1 ex., Pahang, Bukit Rengit, 3°37'N/102°10'E, 24-27 June 1992, Zaidi, Ismail & Zabidi (UKM); 3 ex., Johor, Sagil, Gunung Ledang, 2°22'N/102°36'E, 28 March 1995, Ismail & Ruslan (UKM); 1 ex., Pahang, Kuala Lompat, 3°41'N/102°13'E, 31 Jan 1993, Salleh, Ismail & Ruslan (UKM); 1 ex., Pahang, Kuala Lompat, 3°41'N/102°13'E, 21-22 Nov 1993, Salleh & Ismail (UKM); 2 ex., Pahang, Ekspedisi Endau-Rompin, 2°46'N/103°5'E, 25-27 Jul 1989, Salleh, Ismail & Nor (UKM); 2 ex., Pahang, Kuala Lompat, 3°41'N/102°13'E, 11-13 August 1990, Zaidi & Ismail (UKM); 1 ex., Pahang, Merapoh, 4°41'N/

102°0'E, 23 June 1992, Ismail, Yusuf, Sham & Razali (UKM); 1 ex. Pahang, Pulau Tioman, 2°47'N/104°10'E, 27-31 August, Yusuf, Jamaluddin & Mahbob (UKM); 1 ex. Pahang, Kuala Lompat, 3°41'N/102°13'E, 9 Feb 1990, Ismail & Ruslan (UKM); 1 ex., Johor, Endau-Rompin, 2°26'N/103°15'E, 18-22 March 1999, Ismail & Ruslan (UKM); 1 ex., Pahang, Kuala Lompat, 3°41'N/102°13'E, 8-10 March 1996. Syakiran Samsudin (UKM); 1 ex., Negeri Sembilan, Gemencheh, 2°32'N/102°24'E, 21-23 Julai 1990, Zaidi, Ismail & Zabidi (UKM); 1 ex., Terengganu, Lata Tembakah, 5°39'N/102°25'E, 20 June 1996, Ismail & Muzamil (UKM); 2 ex., Pahang, Taman Negara Kuala Keniam, 4°23'N/102°24'E, 29-31 August 1995, Zaidi, Ruslan & M'din (UKM); 2 ex., Pahang, Cameron Highland, Gunung Jasar, 4°28'N/101°21'E 8 April 1976, M. Hata (UKM); *Indonesia*. 1 ex. Sumatra, 3°11'S/103°54'E, 14 Oct 1991, A. Riedel (UKM).

Nadrana raapi (Jacoby, 1897)

Total length. 6.84–8.64 mm (mean: 7.46; n = 5)

Head. Reddish-yellow. Finely punctuated, with significant transverse impression between posterior third of eyes. Eyes large, strongly convex. Antennae elongated, extended to apical third of elytra; third to terminal antennomere densely covered by bristle-like setae. First to eleventh antennomeres light yellow. First antennomere club-shaped, second shortest, third antennomere about two times longer than second; ratio length of second to third antennomere 0.43-0.83 mm (mean: 0.57); ratio



Figs. 1-4. *Nadrana pallidicornis* Baly, 1865: 1. dorsal colour pattern. 2. abdomen: a, female; b, male. 3. spermatheca. 4. medium lobe: a, dorsal; b, ventral; c, lateral.

length of third to fourth antennomeres 0.35-0.47 mm (mean: 0.41); fourth to eleventh antennomeres much longer, even and slenderer (Fig. 5).

Thorax. Pronotum transverse, broad, broadest in the middle part, anterior angle significantly protruding, pronotum with deeply impressed line along lateral margins. Reddish-yellow as head, shiny, smooth, finely punctuated and without transverse depression. Pronotal width 2.16-2.52 mm (mean: 2.29), ratio length to width 0.40-0.51 mm (mean: 0.45). Scutellum large, triangular, impunctate, reddish-yellow. Elytra elongated, black at posterior and reddish-yellow at $\frac{3}{4}$ posterior part of each elytron. Elytra shiny, punctation fine, slightly coarser and denser compared to pronotum. Elytra length 5.16-6.72 mm (mean: 5.69), maximum width for both elytron 3.80-4.60 mm (mean: 4.14), ratio of maximum width of both elytron together to length of elytra 0.68-0.81 mm (mean: 0.73). Legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus reddish-yellow throughout, with dense and fine setae.

Abdomen. Sternite black. Last visible sternite in females rounded at apex, and in males with two deep, parallel-sided incisions (Fig. 4).

Male genitalia. The outer shape of median lobe is symmetry, strongly sclerotized, anterior tapered, rounded and not incised. Middle part of median lobe slightly larger and getting smaller towards the end of posterior part. Orifice wide, almost rounded or circular. Endophallic structures symmetrically arranged, median endophallic spiculae with filamentous shaped, originated and elongated from basal endophallic structure. Only one basal endophallic structure present and connected with orifice. Tactum enlarged at posterior end, rounded at

anterior and not reaching apex of the median lobe (Fig. 6).

Female genitalia. None.

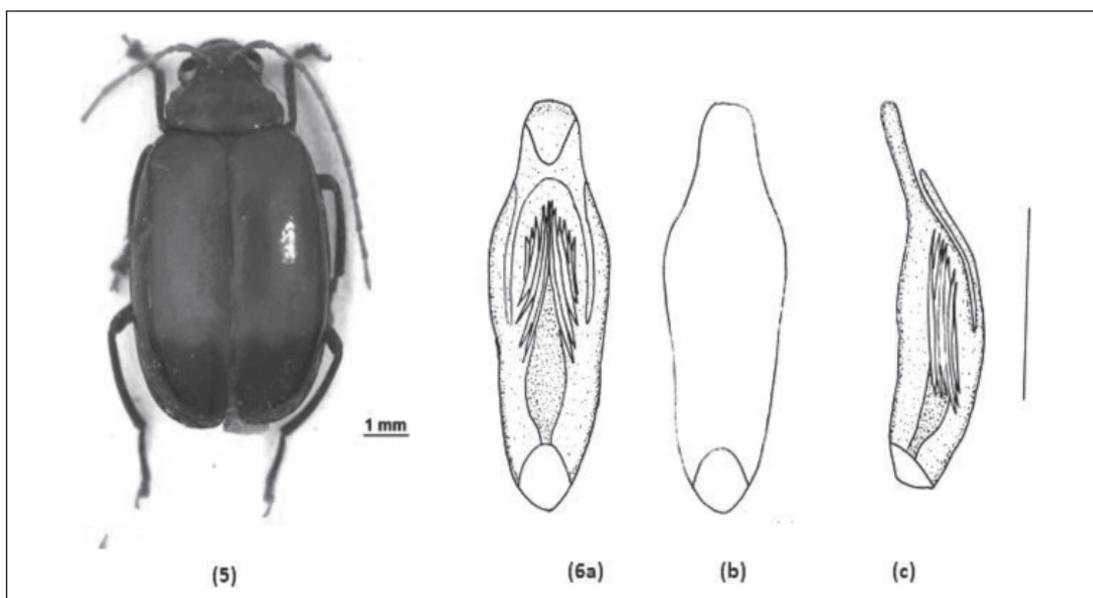
Distribution. The species are restricted to Sundaland area and up to now they are only recorded from Peninsular of Malaysia (Pahang) and Sarawak.

Diagnosis. *Nadrana raapi* is small with total length of 6.84–8.64 mm (mean: 7.46) in comparison with other species in this genus. It has two combinations of colour (bicolour) on the dorsal surface of elytra. This character is also shared by *N. danumensis*, *N. dwiwarna*, and *N. kedenburgi*. For *N. raapi*, $\frac{1}{4}$ posterior part of elytra is black and reddish-yellow at $\frac{3}{4}$ anterior part.

Like all other species in this genus, the outer shape of median lobe is symmetry and has median endophallic spiculae that elongated from basal endophallic structure. The filaments of *N. raapi* slightly shorter compared to other species. According to Mohamedsaid (2004), distribution of *N. raapi* can be found only in Peninsular of Malaysia and Indonesia, however from the specimens available this species also recorded from Sarawak.

Type material. Syntype. *Indonesia*. 1 ex., Batu, 0°11'S/98°29'E, 1896-97, H. Raap, Jacoby Coll. 1909-28a (BMNH).

Further material examined. *Malaysia*. 1 ex., Sarawak, Gunung Mulu, 4°4'N/114°55'E, 1977-78, J. D. Holloway (BMNH); 1 ex., Pahang, Tasik Bera, Kampung Lenek, 3°49'N/102°24'E, 4-8 May 1993, Sham, Razali & Saiful (UKM); 3 ex., Pahang, Kuala Tahan, 4°23'N/102°24'E, 5-9 March 2007, V. Hula, L. Puchart, & F. Ruzicka (CJB).



Figs. 5-6. *Nadrana raapi* (Jacoby, 1897): 5. dorsal colour pattern. 6. medium lobe: a. dorsal; b. ventral; c. lateral.

Nadrana kedenburgi (Weise, 1922)

Total length. 7.80–8.60 mm (mean: 8.04; n = 10)

Head. Black. Finely punctuated, with significant transverse impression between posterior third of eyes. Eyes large, strongly convex. Antennae elongated, extended to apical third of elytra; third to terminal antennomere densely covered by bristle-like setae. First to eleventh antennomeres light yellow. First antennomere club-shaped, second shortest, third antennomere about two times longer than second; ratio length of second to third antennomere 0.44–0.75 mm (mean: 0.63); ratio length of third to fourth antennomeres 0.42–0.62 mm (mean: 0.50); fourth to eleventh antennomeres much longer, even and slenderer (Fig. 7).

Thorax. Pronotum transverse, broad, broadest in the middle part, anterior angle significantly protruding, pronotum with deeply impressed line along lateral margins. Reddish-yellow, shiny, smooth, finely punctuated and without transverse depression. Pronotal width 2.16–2.52 mm (mean: 2.33), ratio length to width 0.46–0.55 mm (mean: 0.49). Scutellum large, triangular, impunctate, reddish-yellow. Elytra elongated, reddish-yellow at anterior and black at $\frac{3}{4}$ posterior part of each elytron. Elytra shiny, punctation fine, slightly coarser and denser compared to pronotum. Elytra length 5.44–7.12 mm (mean: 6.32), maximum width for both elytron 4.44–5.16 mm (mean: 4.65), ratio of maximum width of both elytron together to length of elytra 0.62–0.88 mm (mean: 0.74). Legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus reddish-yellow throughout, with dense and fine setae.

Abdomen. Sternite black. Last visible sternite in females rounded at apex, and in males with two deep, parallel-sided incisions (Fig. 4).

Male genitalia. The outer shape of median lobe is symmetry, strongly sclerotized, both anterior and posterior parts tapered, rounded and not incised. Orifice wide, almost rounded or circular. Endophallic structures symmetrically arranged, median endophallic spiculae with filamentous shaped, elongated from basal endophallic structure. Only one basal endophallic structure present and connected with orifice. Tactum slightly constricted at middle part towards posterior, rounded at anterior and almost reaching apex of the median lobe (Fig. 8).

Female genitalia. Spermatheca with oval to slender and elongated nodulus. Middle part long and slightly curved, cornu long and curved. Without sclerotized bursa sclerites (Fig. 9).

Distribution. The species are restricted to Sundaland area and up to now they are only recorded from Pahang (Tasik Bera) and Sabah (Sepilok, Pulau Gaya, Pulau Banggi & Lembah Danum).

Diagnosis. *Nadrana kedenburgi* is medium in size with total length 7.80–8.60 mm (mean: 8.04). It has two combinations of colour (bicolour) on the dorsal surface of elytra. This character is also shared by *N. danumensis*, *N. dwiwarna*, and *N. raapi*. For *N. kedenburgi*, $\frac{1}{4}$ anterior part of elytra is reddish-yellow and black at $\frac{3}{4}$ posterior part.

The long and filamentous shaped of median endophallic structure and opening of tactum that rounded towards anterior part of median lobe resemble the characteristic of *N. pallidicornis*. Like other species in this genus, the structure of spermatheca is almost similar by having characters like elongated nodulus, middle part long and slightly curved, cornu long.

According to Mohamedsaid (2004), distribution of *N. kedenburgi* only restricted to Sabah, but from the specimens available this species also recorded from Tasik Bera, Pahang.

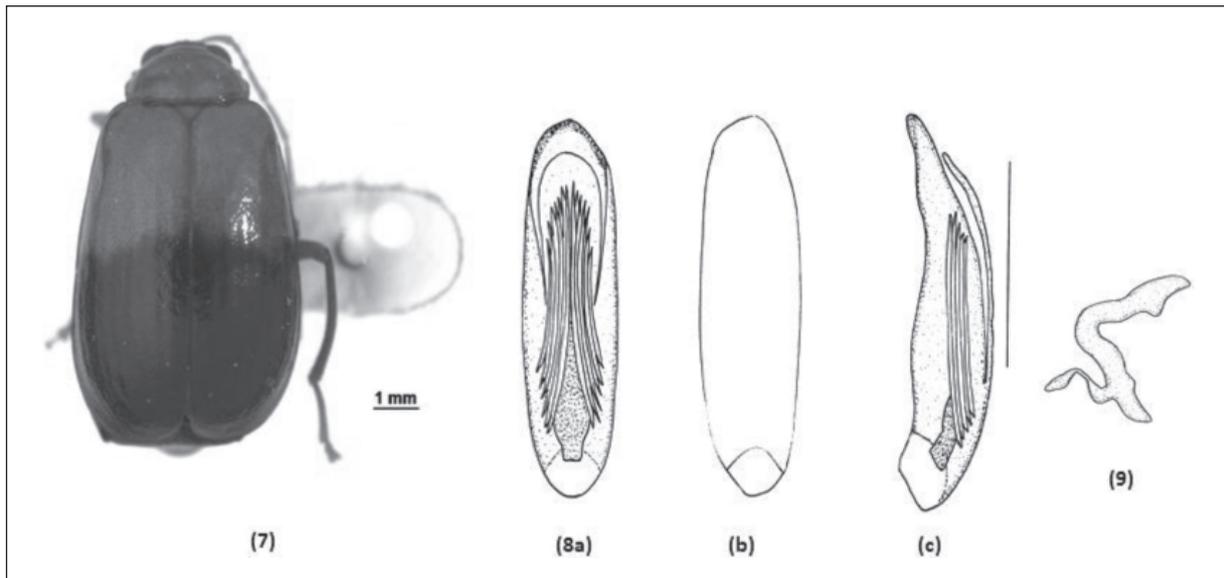
Type material. None.

Further material examined. *Malaysia.* 4 ex., Sabah, Sepilok, 5°52'N/117°57'E, 8–12 Apr 1999, Salleh & Ismail (UKM); 1 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 6–12 June 1989, Ismail (UKM); 15 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 19 August 1989, Salleh, Ismail & Nor (UKM); 18 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 17–20 Apr 1992, Ismail, Yusuf & Razali (UKM); 2 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 4–7 Dis 1990, Zaidi, Ismail & Ruslan (UKM); 2 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 6–8 Sept 1994, Salleh & Ismail (UKM); 2 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 5 Apr 1989, Salleh, Ismail & Nor (UKM); 1 ex., Sabah, Pulau Gaya, 6°1'N/116°1'E, 26–30 Sep 1991, Zaidi & S. Ablm (UKM); 3 ex., Sabah, Pulau Banggi, 7°16'N/117°9'E, 8–12 May 1996, Salleh, Zaidi, Ismail & Sham (UKM); 1 ex., Pahang, Tasik Bera, Kampung Lenek, 3°49'N/102°24'E, 4–8 May 1993, Sham, Razali & Saiful (UKM).

Nadrana dwiwarna Mohamedsaid, 1998

Total length. 7.40–8.72 mm (mean: 8.25; n = 10)

Head. Black. Finely punctuated, with significant transverse impression between posterior third of eyes. Eyes large, strongly convex. Antennae elongated, extended to apical third of elytra; third to terminal antennomere densely covered by bristle-like setae. First to eleventh antennomeres light yellow. First antennomere club-shaped, second shortest, third antennomere about two times longer than second; ratio length of second to third antennomere 0.44–0.88 mm (mean: 0.65); ratio length of third to fourth antennomeres 0.37–0.56 mm (mean: 0.45); fourth to eleventh antennomeres much longer, even and slenderer (Fig. 10).



Figs. 7-9. *Nadrana kedenburgi* (Weise, 1922): 7. dorsal colour pattern. 8. medium lobe: a. dorsal; b. ventral; c. lateral. 9. spermatheca.

Thorax. Pronotum transverse, broad, broadest in the middle part, anterior angle significantly protruding, pronotum with deeply impressed line along lateral margins. Black as head, shiny, smooth, finely punctuated and without transverse depression. Pronotal width 2.40-2.60 mm (mean: 2.50), ratio length to width 0.44-0.53 mm (mean: 0.49). Scutellum large, triangular, impunctate, reddish-yellow. Elytra elongated, reddish-yellow at $\frac{1}{4}$ anterior and black at $\frac{3}{4}$ posterior part of each elytron. Elytra shiny, punctation fine, slightly coarser and denser compared to pronotum. Elytra length 5.72-6.80 mm (mean: 6.34), maximum width for both elytron 4.44-4.92 mm (mean: 4.72), ratio of maximum width of both elytron together to length of elytra 0.69-0.78 mm (mean: 0.74). Legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus reddish-yellow throughout, with dense and fine setae.

Abdomen. Sternite black. Last visible sternite in females rounded at apex, and in males with two deep, parallel-sided incisions (Fig. 4).

Male genitalia. The outer shape of median lobe is symmetry, strongly sclerotized, anterior large, tapered, rounded and not incised. Orifice wide, almost rectangular shaped and connected with basal endophallic structure. Endophallic structures symmetrically arranged, median endophallic spiculae with filamentous shaped, elongated from basal endophallic structure. There are two small plates present and laterally arranged at basal endophallic structure. Tactum reduced in size at posterior, slightly larger at middle part, rounded at anterior part and almost reaching apex of the median lobe (Fig. 11).

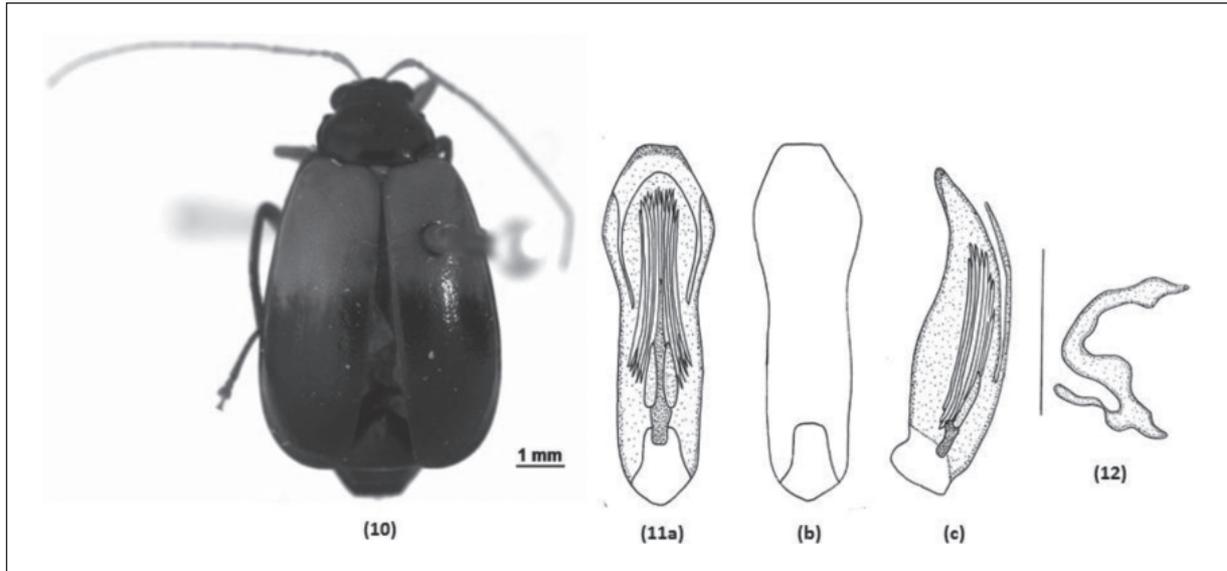
Female genitalia. Spermatheca with oval to slender and elongated nodulus. Middle part long and slightly curved, cornu long and curved. Without sclerotized bursa sclerites (Fig. 12).

Distribution. The species are restricted to Sundaland area and up to now they are only recorded from Sarawak (Gunung Gading & Miri).

Diagnosis. *Nadrana dwiwarna* is relatively medium in size with total length 7.40–8.72 mm (mean: 8.25). It has two combinations of colour (bicolour) on the dorsal surface of elytra. This character is also shared by *N. danumensis*, *N. kedenburgi*, and *N. raapi*. For *N. dwiwarna*, the colour pattern is similar to *N. kedenburgi* by having reddish-yellow at $\frac{1}{4}$ anterior part of elytra and black at $\frac{3}{4}$ posterior part. The only distinct feature that differentiates between these two species is the colour of pronotum, which is reddish-yellow for *N. kedenburgi* and black for *N. dwiwarna*.

N. dwiwarna also has the same characteristics of median lobe and spermatheca. The only different is the present of two small plates at lateral side of basal endophallic structure. The existence of these two plates is similar character that shared by *N. Danumensis* and only these two species have this character in the genus *Nadrana*. As reviewed by Mohamedsaid (2004), distribution of *N. dwiwarna* is restricted to Sarawak.

Type material. Paratype. *Malaysia*. 13 ex., Sarawak, Taman Negara, Gunung Gading, Lundu, $1^{\circ}44'N/109^{\circ}49'E$, 3-6 Nov 1994, Salleh & Ismail (UKM); 3 ex., Sarawak, Taman Negara, Gunung Gading, Lundu, $1^{\circ}44'N/109^{\circ}49'E$, 22-27 Apr 1994, Salleh & Ismail (UKM).



Figs. 10-12. *Nadrana dwiwarna* Mohamedsaid, 1998: **10.** dorsal colour pattern. **11.** medium lobe: a. dorsal; b. ventral; c. lateral. **12.** spermatheca

Further material examined. *Malaysia.* 1 ex., Sarawak, Miri, 4°27'N/113°59'E, 13-15 Jan 1992, Salleh & Zaidi (UKM).

***Nadrana cyanipennis* Mohamedsaid, 1998**

Total length. 7.24–7.92 mm (mean: 7.67; n = 4)

Head. Black. Finely punctuated, with significant transverse impression between posterior third of eyes. Eyes large, strongly convex. Antennae elongated, extended to apical third of elytra; third to terminal antennomere densely covered by bristle-like setae. First to eleventh antennomeres light yellow. First antennomere club-shaped, second shortest, third antennomere about two times longer than second; ratio length of second to third antennomere 0.56–0.67 mm (mean: 0.62); ratio length of third to fourth antennomeres 0.50–0.58 mm (mean: 0.53); fourth to eleventh antennomeres much longer, even and slenderer (Fig. 13).

Thorax. Pronotum transverse, broad, broadest in the middle part, anterior angle significantly protruding, pronotum with deeply impressed line along lateral margins. Black as head, shiny, smooth, finely punctuated and without transverse depression. Pronotal width 2.20–2.32 mm (mean: 2.25), ratio length to width 0.45–0.49 mm (mean: 0.46). Scutellum large, triangular, impunctate, black. Elytra elongated, greenish-blue throughout each elytron. Elytra shiny, punctation fine, slightly coarser and denser compared to pronotum. Elytra length 5.28–6.36 mm (mean: 5.92), maximum width for both elytra 3.92–4.28 mm (mean: 4.13), ratio of maximum width of both elytra together to length of elytra 0.64–0.80 mm (mean: 0.70). Legs long and slender, basi-metatarsus elongated; coxa and

trochanter, femur, tibia and tarsus black throughout, with dense and fine setae.

Abdomen. Sternite black. Last visible sternite in females rounded at apex, and in males with two deep, parallel-sided incisions (Fig. 4).

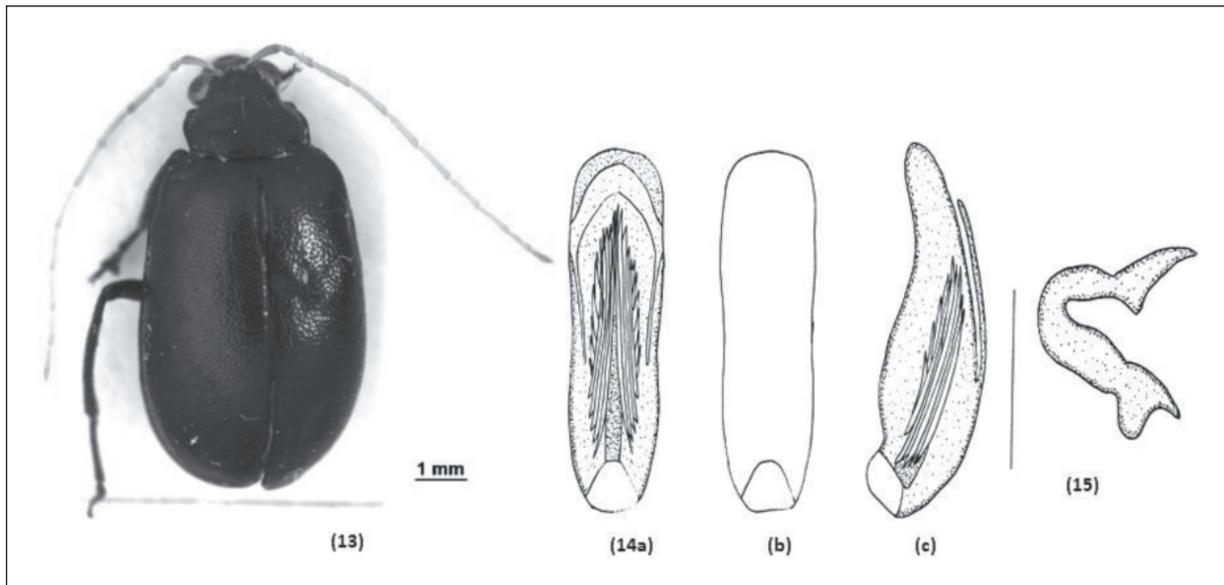
Male genitalia. The outer shape of median lobe is symmetry, strongly sclerotized, anterior tapered, rounded and not incised. Orifice wide, almost rounded or circular. Endophallic structures symmetrically arranged, median endophallic spiculae with filamentous shaped, elongated from basal endophallic structure. Filaments are long and alternately arranged. Only one basal endophallic structure present and connected with orifice. Tactum smaller at posterior, rounded at anterior and not reaching apex of the median lobe (Fig. 14).

Female genitalia. Spermatheca with oval to slender and short nodulus. Middle part long and slightly curved, cornu long and curved. Without sclerotized bursa sclerites (Fig. 15).

Distribution. The species are restricted to Sundaland area and up to now they are only recorded from Pahang (Ringlet) and Sarawak (Bario).

Diagnosis. *Nadrana cyanipennis* small in size 7.24–7.92 mm (mean: 7.67) compared to other species in this genus. It has only one colour pattern (unicolour) on the dorsal surface of elytra and other species that also has this character including *N. pallidicornis* and *N. warisan*. For *N. cyanipennis*, the colour for dorsal elytra is similar to *N. warisan* which is greenish-blue. However, it can be differentiated by looking at the colour of head and pronotum; which are black for *N. cyanipennis* and reddish-yellow for *N. warisan*.

The median lobe structure of *N. cyanipennis* is almost similar to *N. warisan*. The median



Figs. 13-15. *Nadrana cyanipennis* Mohamedsaid, 1998: 13. dorsal colour pattern. 14. medium lobe: a. dorsal; b. ventral; c. lateral. 15. spermatheca

endophallic spiculae are filamentous shaped that elongated from basal endophallic structure and alternately arranged. Like other species, structure of spermatheca is similar but both *N. cyanipennis* and *N. warisan* slightly different from others by having short nodulus.

According to Mohamedsaid (2004), distribution for *N. kedenburgi* only restricted to Sarawak, but from the specimen borrowed it is also recorded from Ringlet, Pahang.

Type material. Holotype. *Malaysia*. 1 ex., Sarawak, Bario, HuluKerangas, 3°44'N/115°27'E, 15 April 1995, Ismail & Ruslan (UKM); Paratype. *Malaysia*. 1 ex., Sarawak, Bario, HuluKerangas, 3°44'N/115°27'E, 13 April 1995, Ismail & Ruslan (UKM).

Further material examined. *Malaysia*. 1 ex., Pahang, Ringlet, 4°25'N/101°22'E, 12-30 Apr 2007, V. Kremitovskiy (CJB).

Nadrana danumensis Mohamedsaid, 2000

Total length. 7.08–8.12 mm (mean: 7.69; n = 10)

Head. Black. Finely punctuated, with significant transverse impression between posterior third of eyes. Eyes large, strongly convex. Antennae elongated, extended to apical third of elytra; third to terminal antennomere densely covered by bristle-like setae. First to eleventh antennomeres light yellow. First antennomere club-shaped, second shortest, third antennomere about two times longer than second; ratio length of second to third antennomere 0.38–0.86 mm (mean: 0.63); ratio length of third to fourth antennomeres 0.44–0.64 mm (mean: 0.52); fourth to eleventh antennomeres much longer, even and slenderer (Fig. 16).

Thorax. Pronotum transverse, broad, broadest in the middle part, anterior angle significantly protruding, pronotum with deeply impressed line along lateral margins. Black as head, shiny, smooth, finely punctuated and without transverse depression. Pronotal width 2.28–2.60 mm (mean: 2.44), ratio length to width 0.39–0.49 mm (mean: 0.44). Scutellum large, triangular, impunctate, reddish-yellow. Elytra elongated, black at 1/4 posterior and reddish-yellow at 3/4 anterior of each elytron. Elytra shiny, punctation fine, slightly coarser and denser compared to pronotum. Elytra length 5.6–6.72 mm (mean: 6.11), maximum width for both elytron 5.6–6.72 mm (mean: 6.11), ratio of maximum width of both elytron together to length of elytra 5.6–6.72 mm (mean: 6.11), Legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus reddish-yellow throughout, with dense and fine setae.

Abdomen. Sternite black. Last visible sternite in females rounded at apex, and in males with two deep, parallel-sided incisions (Fig. 4).

Male genitalia. The outer shape of median lobe is symmetry, strongly sclerotized, anterior large, tapered, rounded and not incised. Orifice wide, almost rectangular shaped and connected with basal endophallic structure. Endophallic structures symmetrically arranged, median endophallic spiculae with filamentous shaped, elongated from basal endophallic structure. There are two long plates present and laterally arranged at basal endophallic structure. The middle and posterior part of tactus similar in size, rounded at anterior part and not reaching apex of the median lobe (Fig. 17).

Female genitalia. Spermatheca with oval to slender and elongated nodulus. Middle part long and slightly curved, cornu long and curved. Without sclerotized bursa sclerites (Fig. 18).

Distribution. The species are restricted to Sundaland area and up to now they are only recorded from Sabah (Lembah Danum, Sepilok, Tawau, Pulau Gaya & Beaufort), Perak (Belum, Pondok Tanjong, Bukit Larut, Taping & Temenggor), Selangor (Bangi & Rawang) and Negeri Sembilan (Lenggong).

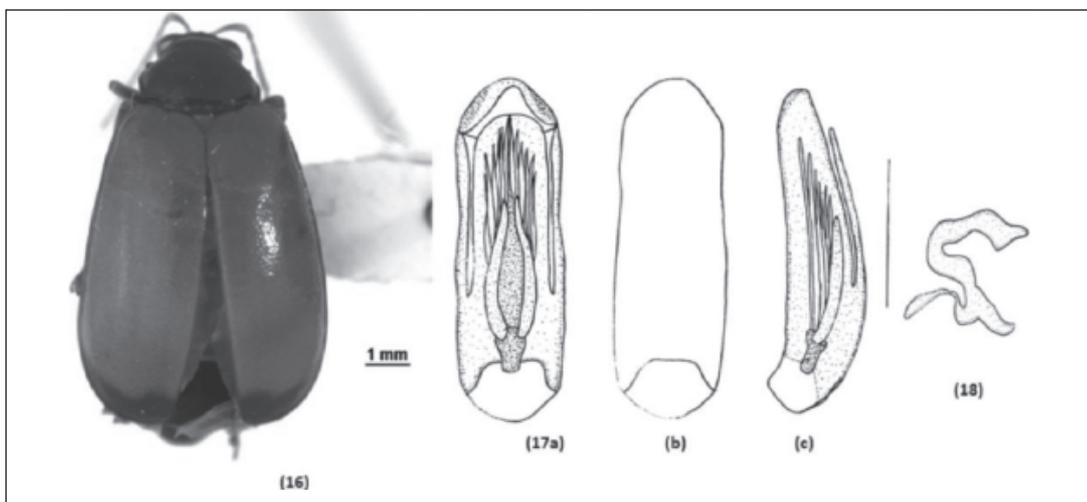
Diagnosis. *Nadrana danumensis* is small in size with total length 7.08–8.12 mm (mean: 7.69). It has two combinations of colour (bicolour) on the dorsal surface of elytra. This character is also shared by *N. dwiwarna*, *N. kedenburgi*, and *N. raapi*. For *N. danumensis*, the colour pattern is similar to *N. raapi* by having black at 1/4 posterior part of elytra and reddish-yellow at 3/4 anterior part. However these two species can be differentiated by looking at the colour of head and pronotum, which are entirely black for *N. Danumensis* and reddish-yellow for *N. raapi*.

The outer shape of median lobe is symmetry and rounded at anterior part. It has median endophallic spiculae that filamentous shaped, short and elongated from basal endophallic structure. There are two long plates on the lateral side of basal endophallic structure. *N. dwiwarna* also has the same structure but slightly shorter. As in other species, middle part of spermatheca is long, cornu curved and elongated nodulus.

According to Mohamedsaid (2004), *N. danumensis* only can be found in Sabah, but from the available specimens, this species also recorded from Perak (Belum, Pondok Tanjong, Bukit Larut, Taping & Temenggor), Selangor (Bangi & Rawang) and Negeri Sembilan (Lenggong).

Type material. Paratype. *Malaysia*. 1 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 27-31 August 1991, Salleh, Zaidi, Ismail & Ruslan (UKM); 1 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 5-8 Dis 1992, Ismail, Yusof & Razali (UKM); 1 ex., Sabah, Lembah Danum, 5°26'N/118°23'E, 4-7 Dis 1990, Zaidi, Ismail & Ruslan (UKM); 2 ex., Sabah, Lembah Danum, 5°26'N/118°23'E 17-20 Nov 1992, Ismail, Yusof & Razali (UKM).

Further material examined. *Malaysia*. 1 ex., Sabah, Sepilok, 5°52'N/117°57'E, 8-12 Apr 1999, Md Salleh & Ismail (UKM); 1 ex., Sabah, Tawau, 4°18'N/117°55'E, 4-12 May 1992, Ruslan (UKM); 5 ex., Sabah, Pulau Gaya, 6°1'N/116°1'E, 26-30 Sept 1991, Zaidi & S. Abln (UKM); 1 ex., Selangor, Bangi UKM, 2°55'N/101°46'E, 9 Julai 1994, Ismail, Ruslan & Saiful (UKM); 1 ex., Perak, Belum, 5°36'N/101°20'E, 15-20 Nov 1993, Salleh, Ismail & Sham (UKM); 1 ex., Selangor, Sungai Kanching, 3°18'N/101°36'E, 14 Sep 1974, B. & D. Kurtak (UKM); 2 ex., Selangor, Bangi UKM, 2°55'N/101°46'E, 16 May 1974, B. & D. Kurtak (UKM); 1 ex., Negeri Sembilan, Lenggong, 2°51'N/101°58'E, 2-4 Jul 1993, Ismail & Sham (UKM); 1 ex., Perak, Pondok Tanjong, 5°4'N/100°44'E, 12 June 1991, Ismail & Yusof (UKM); 1 ex., Perak, Bukit Larut, 4°51'N/100°47'E, 8-9 March 1990, Ismail & Ruslan (UKM); 25 ex., Sabah, Pulau Gaya, 6°1'N/116°1'E, 26-30 Sep 1991, Zaidi & S. Abln (UKM); 1 ex., Perak, Taiping, 4°51'N/100°44'E, 13-15 June 1991, Ismail & Yusof (UKM); 5 ex., Sabah, Beaufort, 5°22'N/115°43'E, 6 Dis 1991, Zaidi, Lan & Yus (UKM); 1 ex., Selangor, Templer Park, 3°17'N/101°37'E, 4 Jan 1992 (UKM); 1 ex., Perak, Temenggor, 5°19'N/101°12'E, 29 Nov–5 Dis 1993, Ismail, Yusuf, Bidi & Saiful (UKM); 2 ex., Sabah, Tawau, 4°18'N/117°54'E, 5-10 Apr 2000, Salleh, Ismail & Ruslan (UKM).



Figs. 16-18. *Nadrana danumensis* Mohamedsaid, 2000: 16. dorsal colour pattern. 17. medium lobe: a. dorsal; b. ventral; c. lateral. 18. spermatheca.

***Nadrana warisan* Mohamedsaid, 2001**

Total length. 6.72–7.92 mm (mean: 7.44; n = 3)

Head. Reddish-yellow. Finely punctuated, with significant transverse impression between posterior third of eyes. Eyes large, strongly convex. Antennae elongated, extended to apical third of elytra; third to terminal antennomere densely covered by bristle-like setae. First to eleventh antennomeres light yellow. First antennomere club-shaped, second shortest, third antennomere about two times longer than second; ratio length of second to third antennomere 0.55–0.67 mm (mean: 0.59); ratio length of third to fourth antennomeres 0.50–0.65 mm (mean: 0.57); fourth to eleventh antennomeres much longer, even and slenderer (Fig. 19).

Thorax. Pronotum transverse, broad, broadest in the middle part, anterior angle significantly protruding, pronotum with deeply impressed line along lateral margins. Reddish-yellow as head, shiny, smooth, finely punctuated and without transverse depression. Pronotal width 2.12–2.44 mm (mean: 2.31), ratio length to width 0.44–0.49 mm (mean: 0.46). Scutellum large, triangular, impunctate and reddish-yellow. Elytra elongated, greenish-blue throughout each elytron. Elytra shiny, punctation fine, slightly coarser and denser compared to pronotum. Elytra length 24–6.32 mm (mean: 5.93), maximum width for both elytron 4.40–4.52 mm (mean: 4.47), ratio of maximum width of both elytron together to length of elytra 0.72–0.84 mm (mean: 0.75). Legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus reddish-yellow throughout, with dense and fine setae.

Abdomen. Sternite black. Last visible sternite in females rounded at apex, and in males with two deep, parallel-sided incisions (Fig. 4).

Male genitalia. The outer shape of median lobe is symmetry, strongly sclerotized, anterior tapered, almost rounded and not incised. Orifice wide, almost rounded or circular. Endophallic structures symmetrically arranged, median endophallic spiculae with filamentous shaped, elongated from basal endophallic structure. Filaments are long and alternately arranged. Only one basal endophallic structure present and connected with orifice. Tactum smaller at posterior, rounded at anterior and not reaching apex of the median lobe (Fig. 20).

Female genitalia. Spermatheca with oval to slender and short nodulus. Middle part long and slightly curved, cornu long and curved. Without sclerotized bursa sclerites (Fig. 21).

Distribution. The species are restricted to Sundaland area and up to now they are only recorded from Sabah (Gunung Kinabalu, Tawau & Sipitang).

Diagnosis. *Nadrana warisan* is the smallest in size with total length 6.72–7.92 mm (mean: 7.44) compared to other species in this genus. It has only one colour pattern (unicolour) on the dorsal surface of elytra and other species that also has this character including *N. pallidicornis* and *N. cyanipennis*. For *N. warisan*, the colour for dorsal elytra is similar to *N. cyanipennis* which is greenish-blue. However, it can be distinguished by looking at the colour of head and pronotum; which are black for *N. cyanipennis* and reddish-yellow for *N. warisan*.

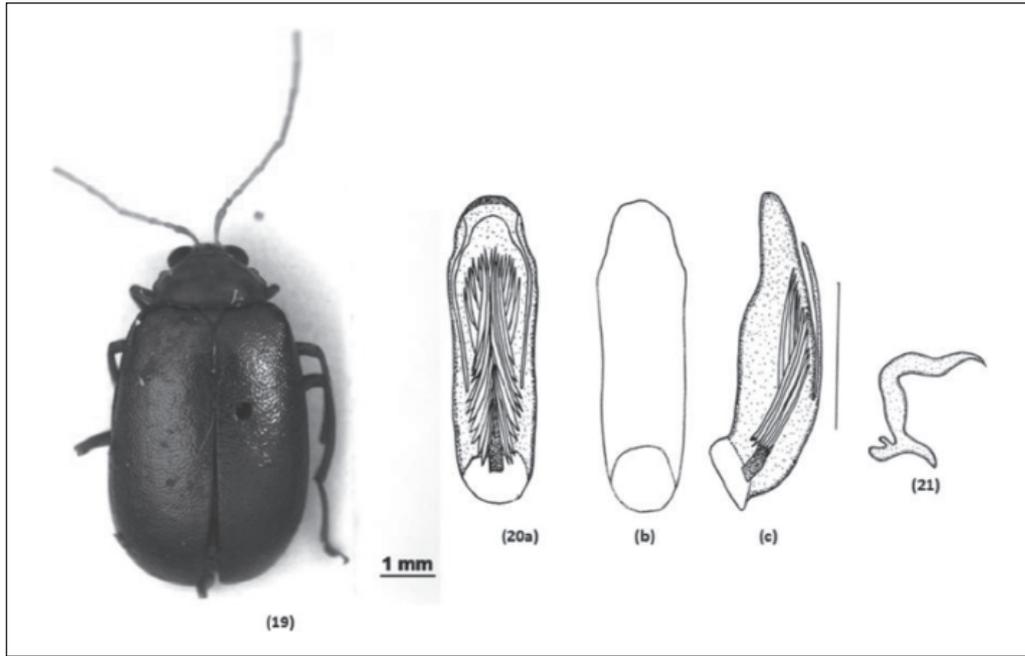
The outer shape of median lobe is symmetry and rounded at anterior part. It has median endophallic spiculae that filamentous shaped, alternately arranged and originated from basal endophallic structure which is similar to *N. cyanipennis*. All species possess the same characteristic of spermatheca; middle part is long and cornu curved except for *N. warisan* and *N. cyanipennis*, these two species have short nodulus. As described by Mohamedsaid (2004), *N. warisan* only can be found in Sabah.

Type material. Paratype. *Malaysia*. 1 ex., Sabah, Tawau, 4°18'N/117°54'E, 4–12 May 1992, Ruslan (UKM). Paratype. *Malaysia*. 1 ex., Sabah, Kampung Palakat, 5°7'N/115°34'E, 1 Nov 1987, Azman Yahya (UKM).

Further material examined. *Malaysia*. 1 ex., Sabah, Gunung Kinabalu, 6°4'N/116°33'E, 2–5 May 1994, Gustafsson, Heinakroon & Pape (NHRS).

Identification key of *Nadrana*

1. One colour (uni-colour) for each elytron, whether black or greenish-blue (Figs. 1, 13 & 19) **2**
 - Combination of two colours (bi-colour) for each elytron; reddish-yellow and black (Figs. 5, 7, 10, 16) **4**
2. Head, pronotum and elytra entirely black, first and second antennomere black, legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus black throughout, with dense and fine setae, the largest in size with total length 8.20–9.48 mm (mean: 8.94), outer shape of median lobe symmetry and median endophallic spiculae with filamentous shaped elongated from basal endophallic structure. This species can be found in Peninsular of Malaysia and Sumatra, Indonesia (Figs. 1, 2 & 3) *N. pallidicornis*
 - Elytron greenish-blue, but different colour of pronotum and head (Figs. 13 & 19) **3**



Figs. 19-21. *Nadrana warisan* Mohamedsaid, 2001: 19. dorsal colour pattern. 20. medium lobe: a. dorsal; b. ventral; c. lateral. 21. spermatheca.

3. Head and pronotum entirely reddish-yellow, antennomeres light yellow, legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus reddish-yellow throughout, with dense and fine setae, the smallest in size with total length 6.72–7.92 mm (mean: 7.44), outer shape of median lobe symmetry and median endophallic spiculae with filamentous shaped, elongated and alternately arranged from basal endophallic structure. This species can be found in Sabah, Malaysia (Figs. 19, 20 & 21) *N. warisan*
 - Head and pronotum entirely black, antennomeres light yellow, legs long and slender, basi-metatarsus elongated; coxa and trochanter, femur, tibia and tarsus black throughout, with dense and fine setae, total length 7.24–7.92 mm (mean: 7.67), outer shape of median lobe symmetry and median endophallic spiculae with filamentous shaped, elongated and alternately arranged from basal endophallic structure. This species can be found in Peninsular of Malaysia and Sarawak (Figs, 13. 14 & 15) *N. cyanipennis*
4. 1/4 anterior part of elytron reddish-yellow and 3/4 posterior part black (Figs. 7 & 10) **5**
 - 3/4 anterior part of elytron reddish-yellow and 1/4 posterior part black (Figs. 5 & 16) **6**
5. Head and pronotum entirely black, antennomere light yellow, total length 7.40–8.72 mm (mean: 8.25), median lobe is symmetry and median endophallic spiculae filamentous shaped, there are two small plates laterally arranged at basal endophallic structure. This species only can be found in Sarawak (Figs. 10, 11 & 12) *N. dwiwarna*
 - Head black whereas pronotum reddish-yellow, antennomere light yellow, total length 7.80–8.60 mm (mean: 8.04), median lobe is symmetry and median endophallic spiculae filamentous shaped, elongated from basal endophallic structure. This species only can be found in Peninsular of Malaysia and Sabah (Figs. 7, 8 & 9) *N. kedenburgi*
6. Head and pronotum entirely black, antennomere light yellow, total length 7.08–8.12 mm (mean: 7.69), median lobe is symmetry and median endophallic spiculae filamentous shaped, there are two long plates laterally arranged at basal endophallic structure. This species only can be found in Peninsular of Malaysia and Sabah (Figs. 16, 17 & 18) *N. danumensis*
 - Head and pronotum entirely reddish-yellow, antennomere light yellow, total length 6.84–8.64 mm (mean: 7.46), median lobe is symmetry, median endophallic spiculae filamentous shaped and slightly short and connected with basal endophallic structure. This species only can be found in Peninsular of Malaysia and Sarawak (Figs. 5 & 6) *N. raapi*

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