

8. The Platystictidae of the Moluccas and Misool (Odonata)

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With 62 figures

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Abstract

The Platystictidae of the Moluccas and Misool (Indonesia) are revised. All species are assigned to *Drepanosticta* Laidlaw. Representatives of this genus are known from the larger islands in the region, viz. Halmahera, Bacan, Obi, Ambon, Buru, Seram, and from the Kai island group. Aru is poorly studied for odonates, and no platystictids are known. Nine new species are described, viz. *Drepanosticta halmahera* sp. n., *D. rudicula* sp. n., *D. sembilanensis* sp. n. and *D. siu* sp. n., all from Halmahera; *D. bifida* sp. n. and *D. psygma* sp. n. from Bacan; *D. misoolensis* sp. n. from Misool; *D. amboinensis* sp. n. from Ambon and *D. obiensis* sp. n. from Obi. Two previously described species, *D. robusta* Fraser (Kai) and *D. moluccana* Lieftinck (Buru), are redescribed and illustrated. A key to all species is provided, as well as preliminary notes on phylogenetic relationships and biogeography. Halmahera platystictids show sister-group relationships with species from Bacan or, remarkably, Misool. The Moluccan *Drepanosticta* species are assigned to the *D. lymetta* and *D. megametta* species groups, which are also known from the Philippines and the Papuan region, and the *D. moluccana* group, presumably confined to the southern Moluccas. The role of the middle Eocene South Caroline Arc in the distributional history of the *Drepanosticta* species is discussed.

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Introduction

Drepanosticta Laidlaw is one of the most speciose genera of zygopteran odonates worldwide, and the largest genus of Southeast Asia by far. Presently it includes 106 valid species in the Oriental and Papuan regions (van Tol 2006). New species were recently described from the mainland of Southeast Asia (Asahina 1984; Hämäläinen 1999; Wilson & Reels 2003), Hainan (Wilson & Reels 2001), the Philippines (van Tol 2005) and New Guinea (Theischinger & Richards 2005). Several authors have anticipated that the generic division of the Platystictidae of Southeast Asia needs major changes to define monophyletic groups. Recently, two new genera were erected to receive species that could not be assigned to *Platysticta* Selys, 1860, *Protosticta* Selys, 1885 or *Drepanosticta*. *Sinosticta* Wilson was described for a small group of species from southern China (Wilson 1997), and *Sulcosticta* Van Tol for another small group from the Philippines (van Tol 2005). Wilson (1997) also erected the new subfamily Sinostictinae for the aberrant genus *Sinosticta*, sharing several characters with the strictly New World subfamily Palaemnematinae. The

phylogenetic relationships of the Platystictidae are still poorly understood, and are subject of a study (van Tol in prep.).

The present paper provides a revision of the Platystictidae species of the Moluccas and Misool (Indonesia), including descriptions of nine new species all assigned to the genus *Drepanosticta*. The genus *Protosticta* Selys, which is represented with many species in Sulawesi, is unknown east of Wallacea. The island of Misool does not belong to the Indonesian province of the Moluccas (Maluku); biogeographically it is considered part of the Papuan region. However, one species of *Drepanosticta* from Misool appeared to be very closely related to a species confined to Halmahera and is included in this paper. The Indonesian province of the Moluccas encompasses a land area of about 78,000 km², of which the islands of Wetar, Yamdena, Aru, Seram, Buru, Taliabu, Obi, Halmahera and Morotai/Rau are larger than 2000 km². The area of sea of the province stretches over 776,500 km² (Monk et al. 1997).

The region between Sulawesi and New Guinea is relatively poorly studied for Odonata. Field work focusing on, or with significant results of, odonates is restricted to (collections including Platystictidae with an ^a sign; all material preserved in RMNH, except if mentioned otherwise). Ternate: 1861 (H. A. Bernstein), 1995 (J. van Tol). Halmahera: 19th century (P.J.M. Lorquin, in IRSNB), 1861 (H. A. Bernstein) ^a, 1931 and 1933 (M. J. van Diejen), 1951 (Amsari & Manis, names of collectors not on labels) ^a, 1981 (A.C. Messer & P.M. Taylor, in USNM), 1995 (J. van Tol) ^a. Morotai: 1861-1862 (A. H. Bernstein). Bacan: 1953 (A. M. R. Wegner) ^a, 1985 (F.G. Rozendaal) ^a. Buru: 1921-1922 (L.J. Toxopeus) ^a, 1941 (J.J. van der Starre) ^a. Obi: 1862 (H. A. Bernstein), 1953 (A.M.R. Wegner) ^a. Seram: 1912 (H. Elgner) ^a. Ambon: 1921 (L.J. Toxopeus), 1941 (J.J. van der Starre), 1948, 1949 (M.A. Liefstinck) ^a, 1961 (A.M.R. Wegner) ^a. Saparua I., 1949 (M.A. Liefstinck). Aru: 1908 (H. Merton) (Ris 1913), 1910-1912 (H. Elgner), 1938 (P. Buwalda), 1939 (R.G. Wind). Kai: 1908 (H. Merton), 1922 (H.C. Siebers) ^a. Tanimbar: 1938 (P. Buwalda). Several of the islands west of or around the Vogelkop

of New Guinea have been studied for odonates as well; only the results of Liefstinck's field work in Misool (1948) are included in the present paper.

The first record of Platystictidae from the Moluccas is *Platysticta bicornuta* Selys (= *D. bicornuta* (Selys)) for Ceram (Seram) (Ris 1915). The identification of this specimen has been changed several times, and its status is still uncertain. Fraser (1926) described *Drepanosticta robusta* from Kei Island, and Ris (1929) recorded *D. auriculata* (Selys) from Buru, noting that also the female *D. bicornuta* from Seram in Ris (1915) may pertain to this species. Liefstinck (1949) renamed the Buru material as *D. moluccana* Liefstinck, and provisionally included the Seram female under this name as well. Redescriptions of previously described species are included in the present paper.

Material and methods

This paper is exclusively based on material in the Leiden museum (RMNH). Most specimens remained largely unstudied for more than fifty years, although M. A. Liefstinck had provisionally sorted them by species. Recent material was collected by Mr. F. G. Rozendaal in Bacan in 1985, and by myself during field work in Halmahera in 1995. In total 295 specimens were studied, including the types of the previously described *Drepanosticta robusta* Fraser and *D. moluccana* Liefstinck (both in RMNH). Per island the numbers of specimens are: Halmahera 28, Bacan 226, Obi 10, Ambon 16, Buru 7, Kai 2 and Misool 6. Specimens were studied using binocular microscopes (Leica MZ16A, Olympus). Illustrations were prepared with a camera lucida on a Leica MZ16A. Measurements are in millimeters, and were taken using a standard ruler (abdomen, wings), or indirectly measured from illustrations (pterostigma, anal appendages). JvT numbers are preserved with the specimens studied, written on a label with the specimen(s), or on the 5 × 3 inch label card in the envelope with the specimen.

Morphological terminology follows Watson & O'Farrell (1991). Special terminology of the head

of Platystictidae follows Calvert (1931) and Cowley (1936). Note that the term 'transverse occipital carina' was used in the text by these authors for a structure named 'postoccipital carina' in the illustrations. Only the term 'transverse occipital carina' is in use since that time.

Acronyms used for collections: IRSNB, Royal Belgian Institute of Natural Sciences, Brussels; USNM, US National Museum of Natural History (Smithsonian Institution), Washington DC; RMNH, National Museum of Natural History Naturalis, Leiden.

Phylogeny and biogeography

Phylogeny. The phylogeny and historical biogeography of the Platystictidae of Southeast Asia are the subject of ongoing studies by the author (van Tol in prep.). The following notes represent preliminary remarks on the relationships of the Moluccan species. Based on morphological characters, the *Drepanosticta* species of the region can be divided in three presumably monophyletic groups characterized by one or more unique characters.

Drepanosticta megametta group. Within the genus *Drepanosticta* this group is characterized by a pair of processes on the posterior lobe of the pronotum, which are flat and of which the tips are only slightly wider than the base (e.g., Figs 3-4).

Other, non-unique (symplesiomorphic), characters of the species of this group include the unicolorous brown vertex anterior to the ocelli; the unmodified anterior lobe of the pronotum; the simple anal appendages with superiors provided with a more or less distinct spine approximately halfway on the inner surface; the inferior appendages are long and slender, distally compressed, in ventral view emarginate; the synthorax is brown with inconspicuous paler markings. These characters also occur in other, presumably monophyletic groups of *Drepanosticta*.

Distribution. Two species are known from the Philippines, viz., *D. megametta* Cowley (Mindanao) and *D. centrosaurus* van Tol (Mindanao) (van Tol 2005), and at least one undescribed species from the

Bismarck Islands belongs here. Three species described in this paper from Misool and Halmahera are assigned to this group.

Drepanosticta lymetta group. This group is characterized in the genus *Drepanosticta* by a pair of processes on the posterior lobe of the pronotum, of which the tip (of the processes) is club-shaped or forked (e.g., Figs 21-22). Other, non-unique, characters of the species of this group include unicolorously brown vertex anterior to the ocelli; the unmodified anterior lobe of pronotum; the relatively simple anal appendages, with superiors straight, long and slender (e.g. Figs 23-25), lacking the distinct spine on the inner surface, and inferiors slender with tip turned medio- dorsad; synthorax castaneous without conspicuous pale stripes.

Distribution. Five species are known from the Philippines (*D. clados* van Tol from Mindanao, *D. furcata* van Tol from Siquijor, *D. hermes* van Tol from Mindanao, *D. lymetta* Cowley from Mindanao and *D. taurus* Needham & Gyger from Mindanao) (van Tol 2005). An undescribed species from Biak is very similar to the Philippine species of this group, while several species from the mainland of New Guinea also share the group characters as given above. Four species from Halmahera and Bacan described in this paper are assigned to this group.

Drepanosticta moluccana group. This group is characterized in the genus *Drepanosticta* by a transverse pale stripe of the vertex. Other, non-unique, characters of the species of this group include the more or less squarish corners of the posterior margin of the pronotum, not provided with a pair of posterior processes; the anal appendages with superiors relatively short and simple, their outer surface smoothly curved and with a small dorsal denticle; inferiors with distal half straight, the tip bent axiad; synthorax with a distinct pale band over metepisternum and (partly) metepimeron.

Distribution. Southern Moluccas (Kei, Obi, Buru, Ambon, and presumably also Seram). *D. moluccana* was described by Liefstinck (1938). *D. robusta* Fraser is known from Kei; the male is poorly described and only known from one incomplete specimen. Two new

species are described in this paper from Ambon and Obi. All four species are morphologically very similar.

Biogeography. Nearly all species of *Drepanosticta* have small to extremely small ranges (e.g. van Tol 2005), defining areas of endemism of freshwater habitats (Van Tol & Gassmann 2007). Many are island endemics. The Moluccan species generally follow this pattern (Fig. 1).

Island endemism in the Moluccas varies distinctly between various groups of insects. Island endemism is rather low in butterflies (e.g. five out of 200 species in Halmahera, and one out of 214 on Ambon). Comparing the various regions of the Moluccas, only c. 11% of the butterfly species are endemic to the Northern Moluccas (incl. Obi), and 15% to the Central Moluccas (Vane-Wright & Peggie 1994: Table

2). De Jong (1998) also stressed the distinct similarities between butterfly faunas of Halmahera (Northern Moluccas) and Seram (Central Moluccas). Since these islands have very different geological histories, he claimed an overwhelming and permanent role for dispersal rather than island rafting of these island biota. Such patterns are also common in several groups of well-dispersing odonates, e.g., Libellulidae, but island endemism is the rule in many families of Zygoptera in this region (e.g. Protoneuridae, Isostictidae). The strongest pattern links of the butterflies of the Northern and Central Moluccas are to New Guinea (Vane-Wright & Peggie 1994). Such a pattern was not found for the butterfly faunas of Halmahera and Misool, as described below for the sister species *Drepanosticta halmahera* sp. n. and *D. misoolensis* sp.n. Vane-Wright & Peggie did, however, find a link

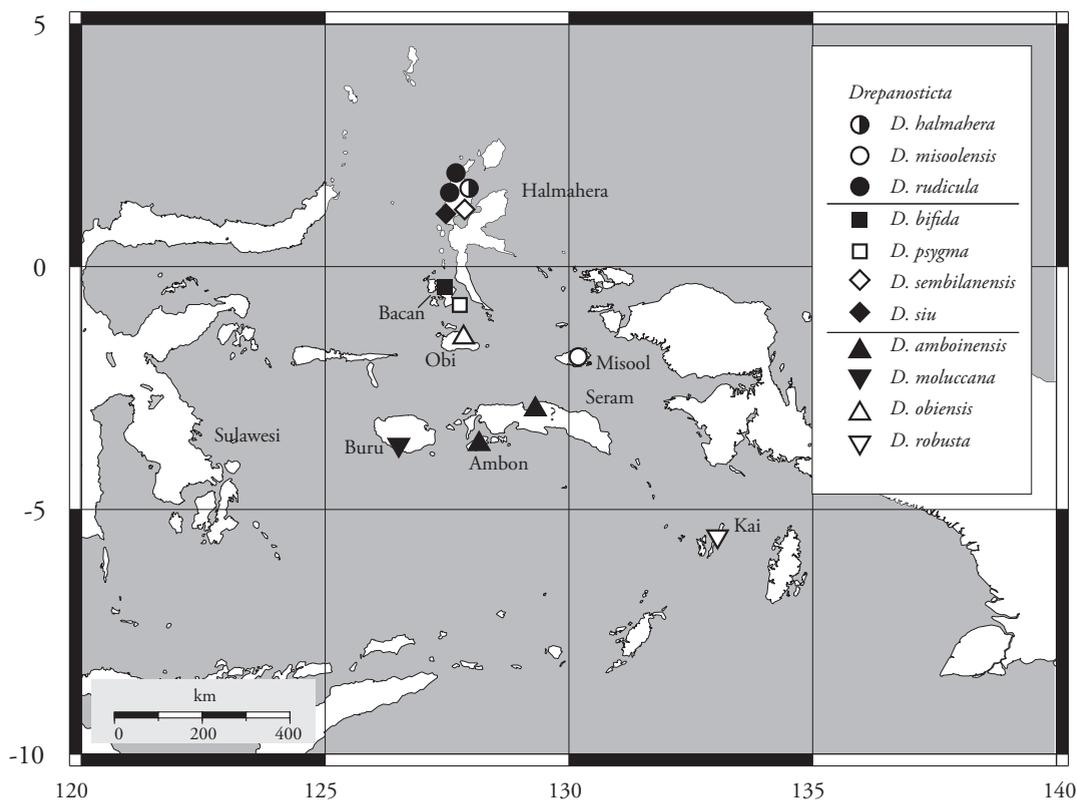


Figure 1. Distribution of *Drepanosticta* species in the Moluccas. Round symbols are used for the species of the *D. megametia* group, quadrangular symbols for those of the *D. lymetta* group, and triangular symbols for those of the *D. moluccana* group.

between the Northern Moluccas and Biak, which seems to be reflected in the *D. lymetta* group as well. The *D. lymetta* and *D. megametia* species groups as distinguished above and based on presumed synapomorphies of their members, reveal a distinct biogeographic pattern along the southern margin of the Philippine Sea Plate (Fig. 2). Several groups of aquatic insects, such as aquatic and semi-aquatic Hemiptera (e.g. Polhemus 1995), and the odonate family Platycnemididae (Gassmann 1999, 2000, 2005, Gassmann & Hämäläinen 2002) show similar patterns. This general pattern seems to have originated largely as a consequence of the geological history of the Philippine and Caroline Arcs (Hall 2002; Hill & Hall 2003).

The Philippine Arc was formed by subduction of the Indo-Australian plate under the Philippine Sea plate, a process that started about 45 Ma. Parts of this Philippine Arc are now forming the islands of the eastern part of the Philippines, while during the early phase (Middle Eocene, about 40 Ma) parts of Sulawesi and Halmahera may have been parts of this arc as well, the so-called Sulawesi – East Philippines –

Halmahera Arc. The Caroline Arc was formed, also at about 40 Ma, at the eastern margin of the Philippine plate due to subduction of the Greater Pacific plate (now subducted) under the Philippine plate. It consisted of an island arc which now predominantly forms the northern half of New Guinea. This arc had an original position far more to the north, while its orientation was nearly north-south. It moved south and rotated clockwise since the Oligocene, forming one island arc with the Philippine arc. From the Late Miocene (10 Ma) it accreted from west to east with ‘proto-New Guinea’, a process continuing up to today. The orientation of the Philippine arc, including Halmahera, changed from east to west into more south to north, due to a complicated set of tectonic processes. The area north of Halmahera became larger due to back-arc spreading, forming the Caroline Sea Plate. The Caroline plate pushed the clockwise-rotating Philippine plate (since 25 Ma) in western direction towards Eurasia. Docking of parts of the arc against the north-western Philippines that started in the Late Miocene (10 Ma), resulted in the origin of western Luzon and some small islands due to the subduction

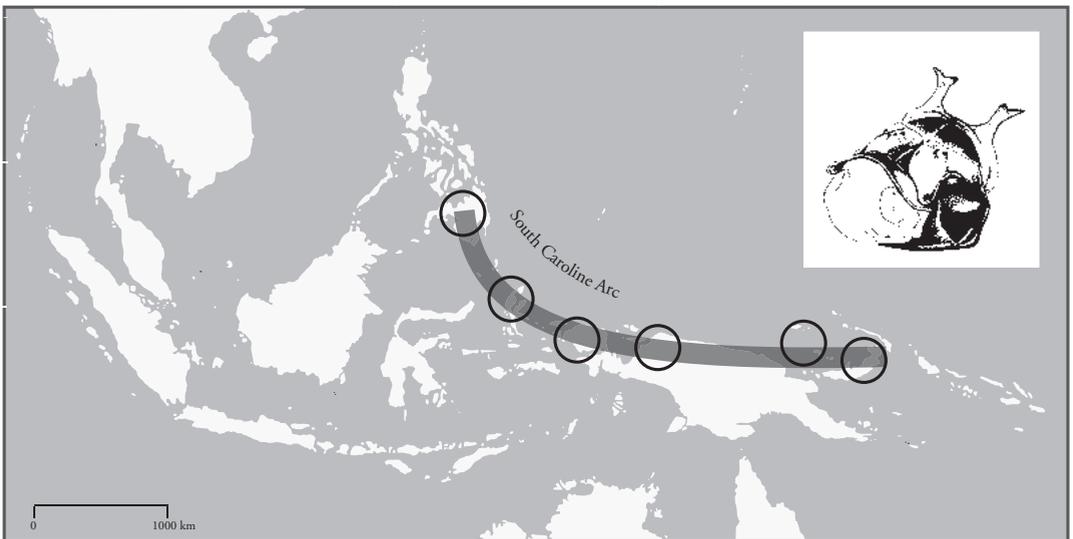


Figure 2. The South Caroline Arc and the distribution of species of the *Drepanosticta lymetta* (including the more distantly related species from New Guinea) and *Drepanosticta megametia* groups in Southeast Asia. The pronotum is that of *D. lymetta* Cowley male (modified after van Tol & Gassmann, 2007).

of the South China Sea Plate under the Philippine Plate. Later on, parts of the arc formed, for instance, the island of Mindanao by amalgamation of extant islands along the eastern margin of Eurasia (Pubellier et al. 1996).

The various ancient island arcs seem to have played an important role in the origin of present distribution patterns of invertebrates of this region. This was demonstrated by Gassmann (2005), who reconstructed the phylogeny of the odonate subfamily Calicnemiinae (Platycnemididae). Representatives of this family frequently occur in the same habitats as the Platystictidae. The calicnemiine genus *Risioenemis* Cowley, confined to the Philippines, appeared to be the sister-group of the genera *Lieftinckia* Kimmins plus *Salomocnemis* Lieftinck, both from the Solomon islands. This clade forms a monophyletic group with all genera from New Guinea (and possibly with the genus *Asthenocnemis* Lieftinck from the Philippines). The calicnemiine platycnemidids are not known from Australia, Halmahera and Sulawesi. These data suggest that the present pattern is due to rafting of odonates on islands of the Philippine arc in western direction. A similar distributional history is hypothesized for the Moluccan and Philippine Platystictidae, although the timing of dispersal in western direction may have been different, as indicated by the presence of this family on Halmahera and Sulawesi. The *D. lymetta* group is at least represented on Biak. Closely related clades occur in New Guinea (van Tol in prep.) and Sulawesi (van Tol, in press). Further analysis has to reveal the phylogenetic position of the Moluccan species, and their role in the distributional history of the family. Platystictidae confirm that the phylogenetic relationships of various groups of insects of the region between New Guinea and the Philippines seem to indicate a historical biogeography of the region hardly foreseen some years ago.

List of species of Platystictidae of the Moluccas

Drepanosticta megametia group

1. *Drepanosticta halmahera* sp. n.
Distribution: Halmahera

2. *Drepanosticta misoolensis* sp. n.

Distribution: Misool

3. *Drepanosticta rudicula* sp. n.

Distribution: Halmahera

Drepanosticta lymetta group

4. *Drepanosticta bifida* sp. n.

Distribution: Bacan

5. *Drepanosticta psygma* sp. n.

Distribution: Bacan

6. *Drepanosticta sembilanensis* sp. n.

Distribution: Halmahera

7. *Drepanosticta siu* sp. n.

Distribution: Halmahera

Drepanosticta moluccana group

8. *Drepanosticta amboinensis* sp. n.

Distribution: Ambon

9. *Drepanosticta moluccana* Lieftinck, 1938

Distribution: Buru

10. *Drepanosticta obiensis* sp. n.

Distribution: Obi

11. *Drepanosticta robusta* Fraser, 1926

Distribution: Kai

Species excluded from the list of Moluccan Platystictidae

Drepanosticta bicornuta (Selys). Misidentification. – A record from Seram (Ris 1915), as *Platysticta bicornuta*, was rectified to *D. auriculata* (Selys) by Ris (1929). Confirmed records of this species are confined to New Guinea.

Drepanosticta auriculata (Selys). Misidentification. – The previous record from Seram (Ris 1929), changed to *D. moluccana* Lieftinck (with question mark) by Lieftinck (1949). Although the specimen was not examined by me, it seems unlikely that it is identical to *D. moluccana*, which is confined to Buru.

Key to the males of *Drepanosticta* from the Moluccas and Misool

1. Posterior margin of posterior lobe of pronotum with a pair of conspicuous processes, which are

- distally wider than basally, apex club-shaped, fan-shaped or bifid (e.g. Figs 16, 28); occiput with distinct transverse occipital carina, usually with angulate lateral extremities; vertex brown or black, concolorous with rest of head 2
- Posterior margin of posterior lobe of pronotum sharp or with elongate triangular corners; apex sharp, not wider than base (Fig. 46); occiput with inconspicuous transverse occipital carina, lateral extremities absent or indistinct; vertex with transverse pale stripe (*D. moluccana* group) 8
2. Superior anal appendage with denticle or tooth in basal half; denticle sometimes rather inconspicuous (e.g. Fig. 18) (*D. megametta* group) 3
- Superior anal appendage basally round, without sharp denticle or tooth (e.g. Fig. 25) (*D. lymetta* group) 5
3. Denticle on superior appendage particularly well visible in dorsal view, less so in lateral view (Figs 17–18); superior appendages in lateral view with upper and lower side subparallel. Distribution: Halmahera *Drepanosticta rudicula* sp. n.
- Denticle on superior appendage particularly well visible in lateral view, less so in dorsal view (Figs 5–6); superior appendages in lateral view club-shaped 4
4. Inferior anal appendage in ventral view slender (Fig. 13); hind wing length c. 19 mm. Distribution: Misool *Drepanosticta misoolensis* sp. n.
- Inferior anal appendage in ventral view stout (Fig. 7); hind wing length c. 22 mm. Distribution: Halmahera *Drepanosticta halmahera* sp. n.
5. Ventrum of synthorax black or brownish black; apical T-shaped part of posterior processes of pronotum approximately as slender as the stalk (Fig. 22) 6
- Ventrum of synthorax dirty yellow; apical T-shaped part of posterior processes of pronotum distinctly heavier than the stalk (Fig. 34) 7
6. Superior anal appendages with distinct ventral subterminal triangular process (Fig. 41). Distribution: Halmahera *D. siu* sp. n.
- Superior anal appendages with ventral side subterminally smoothly rounded (Fig. 23). Distribution: Bacan *D. bifida* sp. n.
7. Inferior anal appendages distinctly longer than superiors (Fig. 35); posterior processes of pronotum T-shaped. Distribution: Halmahera *D. sembilanensis* sp. n.
- Inferior and superior appendages of equal length (Fig. 29); posterior processes of pronotum more or less fan-shaped. Distribution: Bacan *D. psygma* sp. n.
8. Distribution: Kei Island (the male of this species is only known from one teneral, incomplete specimen) *D. robusta* Fraser
- Distribution: Ambon, Buru, Obi 9
9. Inferior anal appendages ventrally with distinct subapical constriction, just before inward bent tip (Fig. 55); pale stripe over metepisternum conspicuous 10
- Inferior anal appendages ventrally without, or with hardly discernable, subapical constriction (Fig. 49); pale stripe over metepisternum inconspicuous. Distribution: Ambon *Drepanosticta amboinensis* sp. n.
10. Terminal part of inferior anal appendages c. two times as long as wide at the top (Fig. 55). Distribution: Buru *Drepanosticta moluccana* Lieftinck
- Terminal part of inferior anal appendages more than three times as long as wide at the top (Fig. 61). Distribution: Obi *Drepanosticta obiensis* sp. n.

***Drepanosticta megametta* group**

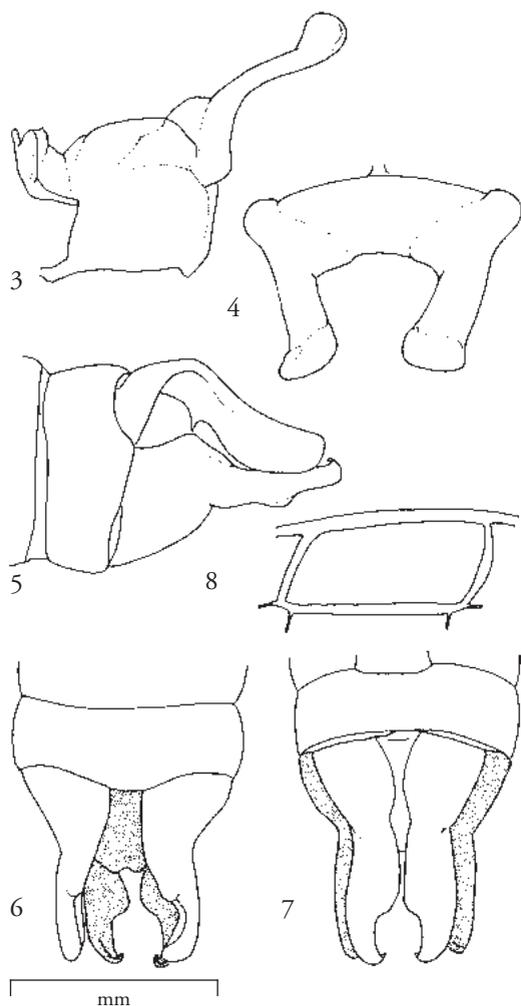
***Drepanosticta halmahera* van Tol, sp. n.**

Figs 1, 3–8

Type material. Holotype male [JvT 10997]: ‘Indonesia (Maluku Utara)/NW Halmahera. 24 km SW of Tobelo/Rivulet S of Tunuo camp (PT Widuri Utama/Timberindo), tributary of Sg Tunuo/c. 1°32’N 127°54’ E. Alt 150–200 m/22 Sep 1995. Leg. J. van Tol/Slowly flowing rivulet 6–8 m, in somewhat/disturbed primary rain forest. Mostly shaded/Clear water. 10–30 (50) cm².

Paratype: 1 male [JvT 10996], same data as holotype.

Medium-sized *Drepanosticta*, with anal appendages



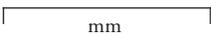
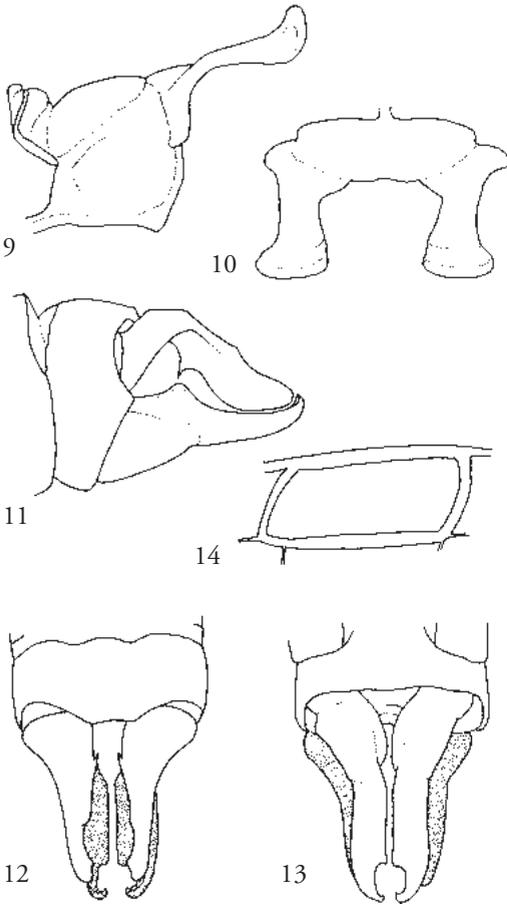
Figures 3-8. *Drepanosticta halmahera* sp. n., male. – 3, pronotum, left lateral view. – 4, posterior lobe of pronotum, dorsal view. – 5, anal appendages, left lateral view. – 6, idem, dorsal view. – 7, idem, ventral view. – 8, pterostigma, right fore wing.

distinctly different from other species known from Halmahera: superiors in lateral view down-curved, inferiors in ventral view constricted in distal half; ventrum black.

Male [holotype, JvT 10997]: Head. Labrum, anteclypeus and mandibles bluish white, anterior onesixth of labrum brown, mandibles with lower anterior corner against eye brownish black; rest of

head brownish black; transverse occipital carina welldeveloped, lateral extremities angulate. Antennae with scapus brownish black, pedicellus dirty yellow, flagellum brown.

Thorax. Pronotum (Figs 3-4) pale brown, anterior lobe erect, widened anteriorly in lateral corners; median part posterior lobe somewhat darker than rest of pronotum, with posterior processes stout, flat over synthorax, curved inwards, the top widened and thickened, squarish at distal margin, length approximately as median line of median lobe. Synthorax with coloration as follows: mesepisternum pale brown, middorsal carina black, mesinfraepisternum brownish black, mesepimeron anteriorly brownish black, posterior from stigma (on metepisternum) pale brown, and dark brown on suture; metepisternum posterior from stigma mostly pale brown, and anterior from stigma brownish black except for triangular marking against stigma; metinfraepisternum brownish black, metepimeron brownish black, except for a broad triangular marking against posterior margin. Legs dirty yellow, hardly darker on joints. Wings hyaline, venation brown; Px in fore wing 17, in hind wing 15; R4 + 5 arising at nodus; IR3 arising halfway first cell distal to subnodus; Ab vein meeting Ac just before hind margin of wing (Y short-stalked); pterostigma (Fig. 8) brown, rather elongate, 2.2 times as wide as high, the proximal corner oblique, but not angulate, anterior and posterior side nearly parallel-sided; cells distal to pterostigma undivided. Abdomen brown, segments 8-10 brownish black, segments with pale markings (annules) as follows: anterior one-eighth of segment 3 dirty yellow, anterior one-sixth of segments 4-5 yellow, anterior one-fourth of segments 6-7 pale and with sagittiform markings, which are somewhat bluish white. Anal appendages (Figs 5-7) brown, inferiors surpassing superiors; superiors in dorsal view constricted near base, distal two-fifths dorso-ventrally flattened, dorsally at three-fifths from base a small blunt process (denticle), at c. two-fifths from base a sharp tooth, directed ventro-axiad; superiors in lateral view with base raised dorsad and distal threefifths turned ventrad; inferiors in ventral view with base strongly tapering, distal half basally straight, parallel-sided, distal two-fifths of distal half constricted,



Figures 9-14. *Drepanosticta misoolensis* sp. n., male. – 9, pronotum, left lateral view. – 10, posterior lobe of pronotum, dorsal view. – 11, anal appendages, left lateral view. – 12, idem, dorsal view. – 13, idem, ventral view. – 14, pterostigma, right fore wing.

dorso-ventrally compressed, the tip turned dorso-axial.

Female. Unknown.

Measurements. Male, abdomen including anal appendages 34 mm, hind wing 22 mm.

Etymology. *Halmahera* (Gr.), after the type locality. A noun in apposition.

Distribution (Fig. 1). Halmahera (Moluccas, Indonesia).

***Drepanosticta misoolensis* van Tol, sp. n.**

Figs 1, 9-14

Type material. Holotype male [JvT 23603]: [Printed label]: 'Misool Id (W.)/0-75 m/8.ix.-20.x.1948/M.A. Liefstinck', [on envelope in MAL's hand]: 'Fakal/19.9.48' and 'nec *bicornuta*, cpd with type Genova X.'59'. Paratypes (four male, one female), same data as holotype, but dates 20 Sep (female, JvT 23605), 23 Sep (male, JvT 23602), 4 Oct (two males, JvT 23600 and 23601), and 7 Oct (male, JvT 23604).

Posterior lobe of pronotum with pair of conspicuous flat processes; rather similar to *D. rudicola* sp. n., but basal interior denticle of superior appendage best visible in lateral view, and inferior appendages with distinct subterminal constriction.

Male [JvT 23603]. Head. Labrum, anteclypeus and mandibles bluish white, anterior one-sixth of labrum brown, mandibles with brownish black marking in latero-anterior corner against eye; postclypeus brown; rest of head mat-black; transverse occipital carina well developed, lateral extremities angulate. Antennae with scapus brownish black, pedicellus dirty yellow, flagellum broken.

Thorax. Pronotum (Figs 9-10) pale brown, median portion of posterior lobe dark brown, lateral lobes dirty yellow; anterior lobe medially expanded; posterior lobe with a pair of posterior processes, stout, wide at base, distally gradually widening, the broad top turned somewhat dorsad; length of process approximately the length of median line of median lobe. Synthorax variegate brownish black with paler medium-brown stripes as follows: dorsal carina black, black coloration of mesepisternum against dorsal carina from anteriormost corner widening posteriorly towards hind margin; mesinfraepisternum brownish black; mesepimeron with black marking anteriorly covering full width of mesepimeron, tapering posteriorly towards lower posterior corner; markings of metepisternum similar to mesepimeron, but metastigma distinctly pale; metepimeron brownish black except for a subsquarish pale marking against posterior margin. Legs dirty yellow, hardly darker on joints. Wings hyaline, venation brown, Px in fore

wing 16, in hind wing 14; R4+5 arising just distal to nodus, IR3 arising halfway first cell distal to subnodus; Arculus just distal to Ax2; Ab vein meeting Ac just before hind margin of wing (Y-vein short-stalked); CuP meeting hind margin in fore wing at level of Px5, in hind wing at level of Px 10; number of cells between Arculus and place where CuP meets hind margin of fore wing 9, of hind wing 14; pterostigma elongate, c. 2.3 times as wide as high, proximal corner oblique, posterior side only somewhat convex; some cells distal to pterostigma divided.

Abdomen brown, segments 9-10 brownish black; pale markings on segment 2-7 distinct, ivory white, as follows: segment 2 with elongate triangular marking anteriorly, and a paired crescent-shaped marking latero-anteriorly; segments 3-6 with pale annule in anterior one-sixth, segment 7 with pale sub-squarish marking medio-anteriorly, c. one-sixth length of segment. Anal appendages brown, inferiors surpassing superiors in length; superiors in dorsal view wide at base, strongly tapering in basal third, distal two-thirds dorso-ventrally compressed, with ventrally directed sharp triangular tooth at base of distal portion, best visible in lateral view; superiors in lateral view with raised basal third, the distal two-thirds bent obliquely ventrad; inferiors in ventral view tapering in basal two-fifths, distal three-fifths parallel-sided at base, then constricted on innerside, the tip slender, curved medio-axiad.

Female [JvT 23605]. Available female rather teneral; largely pale brown, generally as the male; posterior projections of pronotum distinct, as in the male, but shorter; shape of last abdominal segments damaged and distorted.

Measurements. Male, abdomen including appendages 30 mm, hind wing 24 mm; female, abdomen c. 26 mm, hind wing 19 mm.

Etymology. *Misoolensis* (L.), after the type locality. An adjective.

Distribution (Fig. 1). Misool (off western New Guinea, Indonesia).

Drepanosticta rudicula van Tol, sp. n.

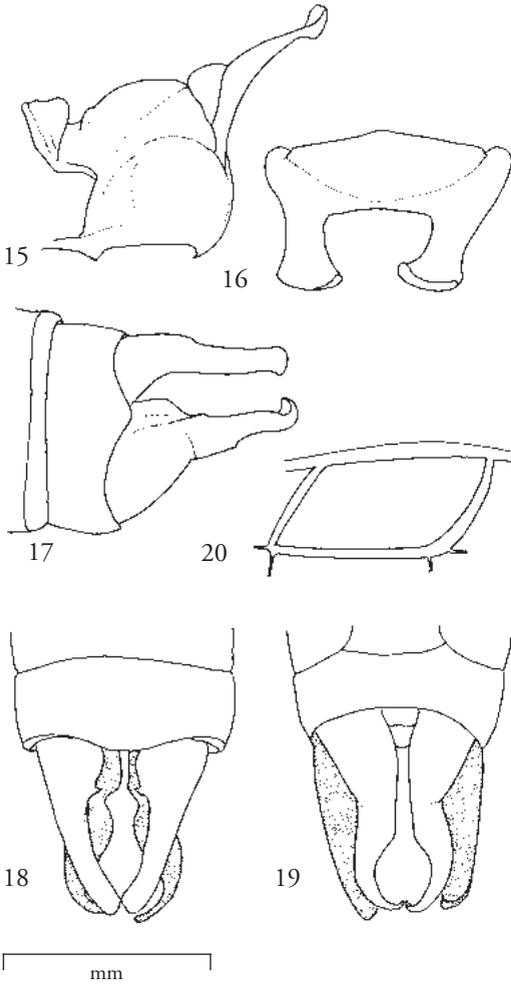
Figs 1, 15-20

Type material. – Holotype male [JvT 10940] 'Indonesia (Maluku Utara)/NW Halmahera. 23 km SW of Tobelo/ Basecamp PT Widuri Utama Timberindo/1°32'40" N 127°54'30" E. Alt 150-200 m. 20 Sep 1995. Leg. J. van Tol/Slowly flowing rivulet, and forest pools, in/somewhat disturbed primary rain forest/ Shaded. Clear water. 20-80 cm'. Paratypes (11 males, 4 females) (all Halmahera): Tolewang, 12-25 Oct 1951, 1 male; 20 km SSW of Tobelo, Sg. Gotoro W of Telaga Paca, c. 1°34' N 127°56' E, 150-200 m, 13-15 Sep 1995, J. van Tol, 7 males, 3 females; same data as holotype, 3 males, 1 female.

Other material (excluded from type series). Noord-Halmahera (Bernstein), 1 male [JvT 19947] [incomplete].

Medium-sized *Drepanosticta*, general coloration brownish black, ventrum of synthorax black, with flattened processes on posterior margin of pronotum, anal appendages slender, of equal length, superiors with basal interior spine, which is well visible in dorsal view (in *D. misoolensis* sp. n. best visible in lateral view); inferiors in ventral view tapering towards tip (in *D. misoolensis* distinctly constricted subterminally).

Male [based on JvT 10668]. Head. Labrum and anteclypeus bluish white, anterior one-fifth of labrum black, mandibles brownish black with large, subsquarish white marking in basal corner against anteclypeus; rest of head black, postclypeus and frons shining, rest coriaceous, transverse occipital carina well-developed, lateral extremities angulate. Antennae with scapus brownish black, pedicellus dirty yellow at base, darkening against flagellum, flagellum castaneous. Thorax. Pronotum (Figs 15-16) dorsally brown, lateral lobes dirty yellow, anterior lobe castaneous, erect, with distinctly wider and flattened parts on both sides of median line, median lobe brown, although portions against lateral lobes paler; posterior lobe with median lobe brownish black, lateral parts and processes pale brown; paired process short and stout, approximately length of median line of posterior lobe, both processes wide apart, the distal one-third expanded, distal margin squarish and thickened. Synthorax nearly black, but faint paler markings as follows: mesepisternum except



Figures 15-20. *Drepanosticta rudicula* sp. n., male. – 15, pronotum, left lateral view. – 16, posterior lobe of pronotum, dorsal view. – 17, anal appendages, left lateral view. – 18, idem, dorsal view. – 19, idem, ventral view. – 20, pterostigma, right fore wing.

for dorsal carina, posterior half of mesepimeron, metepisternum posterior to metastigma, and a small triangular marking in posteriormost portion of metepimeron (synthorax unicolorously castaneous in other specimens). Legs dirty yellow, femora with dark rings against joints with tibiae. Wings hyaline, reaching to halfway segment 6 of abdomen; venation brown; Px in fore wing 17, in hind wing 16; R4 + 5 arising at or just distal to nodus; IR3 halfway first cell distal

to subnodus; Ab vein meeting Ac just before hind margin of wing (Y short-stalked); CuP meeting hind margin of fore wing at level of Px 5, in hind wing at level of Px 10; number of cells between Arculus and place where CuP meets hind margin of hind wing 14; pterostigma (Fig. 20) brown, 1.7 times as wide as high, proximal and distal side more or less parallelsided, proximal corner sharp, but not angulate; cells distal to pterostigma undivided.

Abdomen. Segments 1-2 brown, segments 8-10 black, other segments brown with paler markings as follows: anterior one-tenth of segment 3, anterior one-sixth of segments 4-6, anterior one-fifth of segment 7. Anal appendages (Figs 17-19) dark brown, superiors in dorsal view stout in basal onethird, more slender in flattened distal two-thirds, with short triangular process at one-third from base, directed ventro-axiad; inferiors with basal two-fifths relatively slender, parallel-sided, distal three-fifths bent outward and then inward again, especially on inner surface, the tips bent dorsad and touching.

Female [JvT 10810]: Similar to the male, but posterior processes of pronotum shorter and terminally hardly expanded; pale markings somewhat larger and more conspicuous than in holotype, abdominal segments 8-10 brownish black, valves black, terebra brown, both just surpassing the pale brown anal appendages; stylus brownish black.

Variation. Females vary in structure of the hind margin of pronotum. Some specimens have conspicuous processes similar to those of the male [JvT 10810], while an otherwise indistinguishable female (based on shape of anterior margin of pronotum) has a rounded posterior margin of the pronotum without any indication of a process [e.g. JvT 10671].

Measurements. Male, abdomen including anal appendages 32 mm, hind wing 22 mm (specimen JvT 10939 much smaller, with hind wing 20 mm, abdomen incl. appendages 28 mm); female, abdomen 32 mm, hind wing 23 mm.

Etymology. *Rudicula* (L.), spoon, for the shape of the prothoracic process. A noun in apposition.

Distribution (Fig. 1). Halmahera (Moluccas, Indonesia).

Drepanosticta lymetta group

Drepanosticta bifida van Tol, sp. n.

Figs 1, 21-26

Type material. — Holotype male [JvT 23730]: 'Salawaku river/ Batjan Isl. 150-100 m, 13 Jun 1953' [two stamped labels] [collected by A.M.R. Wegner], in RMNH.

Paratypes: same data as holotype, 12-14 Jun 1953: 139 males, 10 females; Sibela Mtn, 1 Jul 1985, 12 males, 1 female; Sibela Mtn, 3 Jul 1985, 4 males, 1 female; Ake Songu river, 9 Jul 1985, 1 male; Timber camp, 15 Jul 1985, 2 males (all in RMNH).

Rather small, castaneous species with pair of bifurcate processes on posterior margin of pronotum. Ventrum of synthorax dark. Differs from other species from Bacan, *D. psigma* sp. n., by dark ventrum of synthorax and very short median line of posterior lobe of pronotum (less than half the length of process).

Male [holotype, JvT 23730]. Head. Labrum, mandibles and anteclypeus bluish white; anterior margin of labrum with narrow brown border, not reaching lateral margin, mandibles with darker margin, especially in corner against eye; rest of head brownish black, but brownish transverse stripe in front of median ocellus; frons and clypeus, and narrow stripe along eyes shining, rest coriaceous; a series of longitudinal striae posterior to antennae; transverse postoccipital carina distinct, with angulate lateral extremities.

Thorax. Pronotum (Figs 21-22) castaneous, lateral lobes darker brown; anterior lobe semi-erect; posterior lobe with paired process, approximately as long as median line of median lobe, rather close together, subparallel, nearly flat over synthorax, straight, the top bifurcate, both fingers subequal, although inner finger somewhat more sturdy (variable between specimens); synthorax castaneous, ventro-posterior portion somewhat shining, rest mat. Legs dirty yellow, femora with narrow dark rings against tibiae. Wings hyaline,

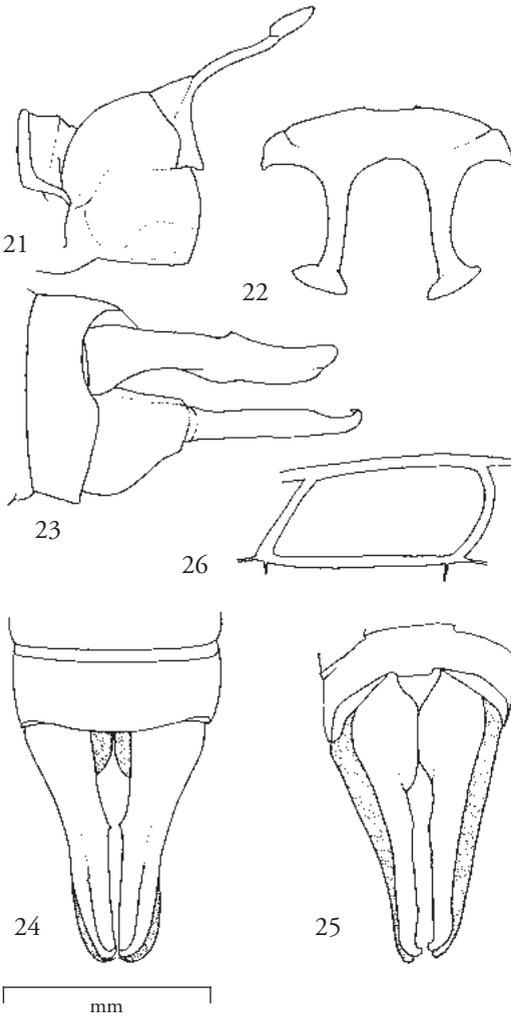
venation brown; Px in fore wing 16, in hind wing 15; R4+5 arising at subnodus, IR3 in anterior half of first cell distal to subnodus; Arculus distal to Ax2; Ab vein meeting Ac at hind margin of wing (Y sessile); number of cells between Arculus and place where CuP meets hind margin of hind wing 14; CuP meeting hind margin of fore wing at level of Px6, in hind wing at Px10; pterostigma (Fig. 26) pale brown, c. 1.9 times as wide as high, proximal side oblique, distal side convex, c. perpendicular to subcosta; few cells distal to pterostigma divided.

Abdomen. Segments 1-7 castaneous, segments 8-10 brownish black; pale markings on abdomen inconspicuous, as follows: latero-anterior corner of segment 3 pale marking approximately onesixth length of segment; pale rings on segments 4-6 of one-fifth, one-fourth and one-third of segment length; segment 7 with pale markings of c. two-fifths length of segment in latero-anterior corner. Anal appendages (Figs 23-25) castaneous, inferiors surpassing superiors, both longer than segment 8 of abdomen; superiors in dorsal view slender, subparallel, c. halfway a small sharp tubercle on innerside; terminal half of superiors dorso-ventrally flattened, with blunt dorsal tooth just posterior to inner tubercle; inferiors also very slender, especially terminal three-fifths, straight except for tip, which is sharply bent medio-dorsad.

Female. Similar to the male, but paired posterior process of pronotum more slender, the top ending in short triangular knob, wings somewhat wider than in male, pterostigma distinctly higher; segments 8-10 of abdomen and valve brownish black; valves and terebra reaching to same level as anal appendages, stylus dark and slender, distinctly surpassing level of anal appendages.

Measurements. Male, abdomen including appendages 30 mm, hind wing 21 mm; female, abdomen 32 mm, hind wing 24 mm.

Etymology. *Bifidus* (Latin), two-fingered, for the shape of the posterior process of the pronotum. An adjective. Distribution (Fig. 1). Bacan (Moluccas, Indonesia).



Figures 21-26. *Drepanosticta bifida* sp. n., male. – 21, pronotum, left lateral view. – 22, posterior lobe of pronotum, dorsal view. – 23, anal appendages, left lateral view. – 24, idem, dorsal view. – 25, idem, ventral view. – 26, pterostigma, right fore wing.

***Drepanosticta psygma* van Tol, sp. n.**

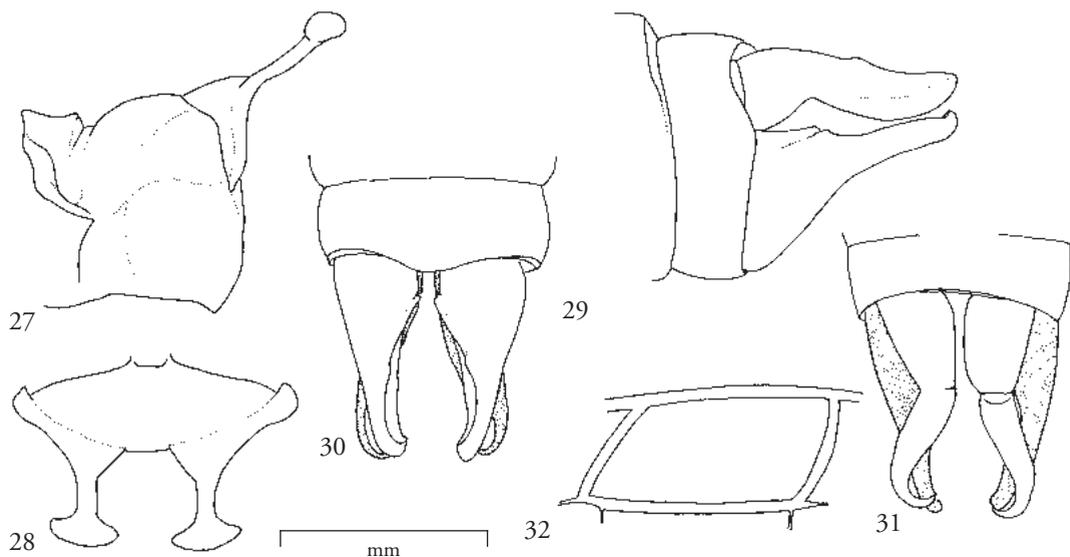
Figs 1, 27-32

Type material. Holotype male [JvT 23542]: 'Salawaku river/ Batjan Isl. 150-100 m' and '13 Jun 1953' [leg. A.M.R.Wegner]. Paratypes (45 males, 8 females): same data as holotype, 12-14 June 1953, 41 males, 5 females; Gn. Sibela, trib. Ake Wayauna, 0°43' S 127°35' E, 850-1000 m, primary forest, natural clearing, 1 July 1985, F. G. Rozendaal, 2 males, 2 females; same, but 750 m, 2 males, 1 female.

Larger than *D. bifida* sp. n., also from Bacan; processes of posterior lobe of pronotum club-shaped; pale stripes over synthorax. Ventrum of synthorax yellow, and median line of posterior lobe of pronotum longer, more than half the length of posterior process.

Male [holotype JvT 23542]. Head. Labrum, mandibles and anteclypeus ivory white, anterior border of labrum brown, medially c. one-sixth the height of mandible and tapering towards latero-anterior corners; rest of head brownish black, but small transverse marking in front of median ocellus, black parts in front of median ocellus shining, rest coriaceous, postocular carina well developed, lateral extremities angulate. Antennae with scapus brown, pedicellus dirty yellow, flagellum brown. Thorax. Pronotum (Figs 27-28) castaneous, but lateral lobes and median portion of posterior lobe darker; posterior margin of posterior lobe with paired process with broad base, strongly constricted, the top knob-like or club-shaped, lying flat over synthorax. Synthorax castaneous, but metepisternum nearly fully dirty yellow, except for posterior margin; metepimeron dirty yellow with large rectangular brown marking anteriorly, c. threequarters length of metepimeron. Legs dirty yellow, but narrow black rings near joints with tibiae. Wings hyaline, venation brown; Px in fore wing 17, in hind wing 16; R4+5 arising at nodus, IR3 halfway first cell distal to subnodus; Ab vein meeting Ac at hind margin of wing (Y sessile); number of cells between Arculus and place where CuP meets hind margin of hind wing 20; CuP meeting hind margin of fore wing at level of Px6, of hind wing at level of Px13; pterostigma (Fig. 32) pale brown, proximal side oblique, distal side convex, c. 1.9 times as wide as high; cells distal to pterostigma undivided.

Abdomen. Segments 1-7 shining castaneous, segments 8-10 brownish black with pale, usually dirty yellow, markings as follows: anterior one-eighth of segment 3 with triangular median spot and a more elongate marking in ventro-anterior corner; segments 4-6 anterior one-sixth pale, most distinct medio-anteriorly; segment 7 somewhat paler anteriorly, but without distinct marking. Anal appendages (Figs 29-31) castaneous or brownish black, inferiors surpassing



Figures 27–32. *Drepanosticta psygma* sp. n., male. – 27, pronotum, left lateral view. – 28, posterior lobe of pronotum, dorsal view. – 29, anal appendages, left lateral view. – 30, idem, dorsal view. – 31, idem, ventral view. – 32, pterostigma, right fore wing.

superiors; superiors in dorsal view stout at base, distal fourfifths dorso-ventrally compressed, the flattened part at least four times as long as high, the top obliquely cut; inferiors in ventral view stout at base, distal three-fifths slender, straight, nearly parallel-sided, the tip tapering bent axiad, but hardly dorsad.

Female. Similar to the male, but posterior projections of pronotum very slender, thread-like, and perpendicular to posterior lobe; segments 9-10 of abdomen short, valve and terebra long, surpassing level of anal appendages; stylus long.

Measurements. Male, abdomen including appendages 36 mm, hind wing 24 mm; female, abdomen 35 mm, hind wing 26 mm.

Etymology. *Psygma* (Gr.), fan, for the shape of the prothoracic processes. A noun in apposition.

Distribution (Fig. 1). Bacan (Moluccas, Indonesia).

***Drepanosticta sembilanensis* van Tol, sp. n.**

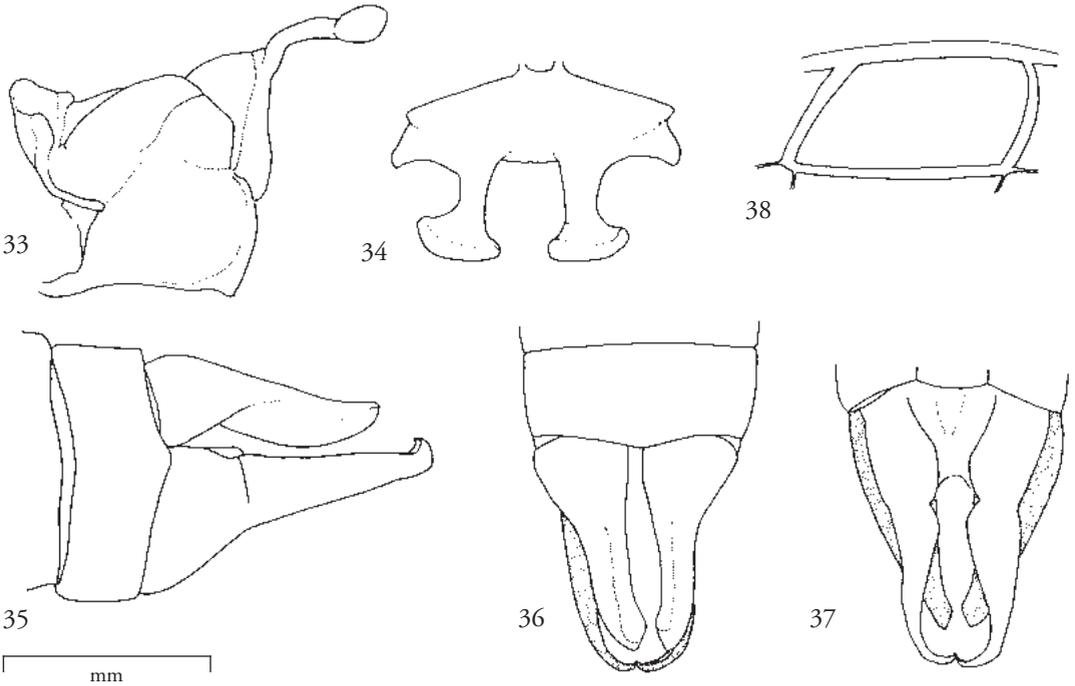
Figs 1, 33-38

Type material. Holotype male [JvT 23495]: 'Isl. Halmahera/ Mt Sembilan 600 m/27/9-6/10 1951' [printed], '8 Oct 1951' [printed] and 'Gn. Sembilan' [handwritten].

Paratypes (2 males) (all Halmahera): Same data as holotype, but 4 Oct 1951, 1 male [JvT 23494]; 20 km SSW of Tobelo. Along Sg Gotoro W of Telaga Paca, c. 1°34'N 127°56'E, 150-200 m, 13-15 Sep 1995, J. van Tol, 1 male [JvT 10812].

A large and robust species of the *D. lymetta* complex; ventrum of synthorax pale; general appearance castaneous, superior anal appendages of male distinctly shorter than inferiors, superiors elongate club-shaped without tooth or denticle.

Male [holotype, JvT 23495]. Head. Labrum, mandibles and anteclypeus yellow (bluish yellow), labrum and mandibles with narrow anterior brownish black border, approximately one-tenth the height of labrum, but somewhat more extensive in middle; rest of head black, coriaceous, transverse occipital carina well-developed, with lateral extremities angulate.



Figures 33-38. *Drepanosticta sembilanensis* sp. n., male. – 33, pronotum, left lateral view. – 34, posterior lobe of pronotum, dorsal view. – 35, anal appendages, left lateral view. – 36, idem, dorsal view. – 37, idem, ventral view. – 38, pterostigma, right fore wing.

Antennae with scapus brown, pedicellus dirty yellow, flagellum brown.

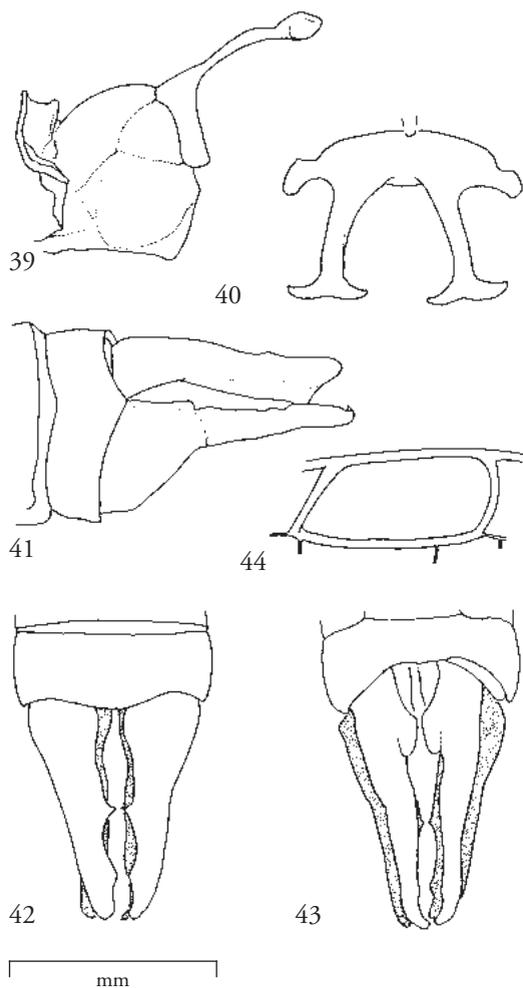
Thorax. Pronotum (Figs 33-34) with anterior lobe brown, median part flat, the sides distinctly erect, median lobe castaneous, lateral lobes darker, posterior lobe dark brown, especially medially, with a pair of posterior processes, T-shaped, stout and flat, the transverse terminal part approximately as long as the stem, total length of process approximately middorsal length of median lobe. Synthorax dark brown, but lower half castaneous, no antehumeral stripe. Legs dirty yellow, femora near joints with dark rings. Wings hyaline, venation brown; Px in fore wing 18, in hind wing 17; R4+5 arising at or just distal to nodus; IR3 arising halfway first cell distal to subnodus; Arculus distinctly distal to Ax2; Ab vein joining Ac at or just before hind margin of wing (Y unstalked or very short-stalked); CuP reaching hind margin of fore wing at Px5, of hind wing at Px10; number of cells between Arculus and place where CuP meets hind margin of

fore wing ten, of hind wing 15; pterostigma (Fig. 38) castaneous, c. 1.9 times as wide as high, proximal corner angulate, cells distal to pterostigma undivided. Abdomen. Segments 1-7 castaneous, and segments 8-10 brownish black, paler medio-anterior markings on dorsum of segments as follows: onetenth of segment 3, one-sixth of segment 4, onefifth of segment 5, and one-sixth of segment 6. Anal appendages (Figs 35-37) brown, the inferiors darker; inferiors distinctly surpassing superiors; superiors elongately club-shaped, without denticles or spines; inferiors slender, nearly straight, the top sharply bent inwards, the tips dorsad and touching.

Female. Unknown.

Measurements. Male, abdomen including anal appendages 39 mm, hind wing 27.5 mm.

Etymology. *Sembilanensis*, for the type locality Gunung Sembilan. An adjective.



Figures 39-44. *Drepanosticta siu* sp. n., male. – 39, pronotum, left lateral view. – 40, posterior lobe of pronotum, dorsal view. – 41, anal appendages, left lateral view. – 42, idem, dorsal view. – 43, idem, ventral view. – 44, pterostigma, right fore wing.

Distribution (Fig. 1). Halmahera (Moluccas, Indonesia); apparently widespread in northern half of the island, but uncommon.

***Drepanosticta siu* van Tol, sp. n.**

Figs 1, 39-44

Type material. Holotype male: 'Isl. Halmahera/Mt. Siu 600-700 m/27/9-6/10 1951' [stamped on envelope], 'G. Siu' [handwritten] and '28 Sep 1951' [stamped] [JvT 23492].

Paratypes: Halmahera, Mt. Sembilan, 600 m, 27 Sep-6 Oct 1951, 3 males 2 females [JvT 23487-23491]; Halmahera, Tugauer-Tasao, 100-150 m, 20-24 Sep 1951, 1 female [JvT 23486].

Very similar to *D. bifida* sp. n. from Bacan, with dark ventrum of synthorax, but males differ in the structure of the paired process of the posterior lobe of the pronotum, and a subterminal ventral triangular projection of the superior appendage.

Male [JvT 23492, holotype]. Head. Labrum, mandibles and anteclypeus creamish white, anterior one-fifth of labrum brownish black, mandibles brownish black along eye, continuing in concave line towards anterior corner near labrum; rest of head black, coriaceous, transverse occipital carina well developed, with lateral extremities angulate. Antennae with scapus brownish black, pedicellus dirty yellow, darkening against flagellum, flagellum brown.

Thorax. Pronotum (Figs 39-40) castaneous, median lobe and central part of posterior lobe somewhat darker; anterior lobe anteriorly erect, without conspicuous emarginations or extensions, posterior lobe with a pair of processes, placed distinctly from lateral corner, the top of each process T-shaped, perpendicular part as wide as stem, process c. as long as median line of median lobe; synthorax concolorous brownish black, only somewhat paler along sutures. Legs dirty yellow, with black markings on all femora near joints of tibiae. Wings clear, venation brown; Px in fore wing 18, in hind wing 17; R4+5 arising just anterior to nodus; IR3 arising in anterior half of first cell distal to subnodus; Arculus distal to Ax2; Ab vein joining Ac just before posterior margin of wing (Y-vein short-stalked); CuP reaching hind margin of hind wing at level of Px11; eleven cells between Arculus and place where CuP meets posterior margin in fore wing, and 15 cells in hind wing; pterostigma (Fig. 44) castaneous, approximately 2.1 times as wide as high, proximal corner angulate; some cells distal to pterostigma divided.

Abdomen. Segments 1 and 9-10 dark brown, other segments castaneous, with paler markings anteriorly

on segments as follows: one-tenth of segment 2, one-eighth of segment 3, one-sixth of segment 4 and one-eighth of segment 5. Anal appendages (Figs 41-43) with superiors brown, inferiors brownish black, superiors long and slender, the top hollowed with subterminal blunt and short tooth, and very short denticle c. halfway on inner side; inferiors just surpassing superiors, straight except for tapering tip, which is bent 90° inward.

Female. Similar to the male, but posterior processes of pronotum more delicate. Abdominal segments 9-10 short, valves and terebra approximately as long as anal appendage; stylus dark and slender, well surpassing level of anal appendage.

Variation. Two females [JvT 23486, 23489] lack the posterior processes of the pronotum, and are doubtfully conspecific; the other female [JvT 23488] is in one envelope with a male [JvT 23487].

Measurements. Male, abdomen including anal appendages 33 mm, hind wing 22 mm; female, abdomen 32 mm, hind wing 22 mm.

Etymology. *Siu*, for the type locality Gunung Siu. A noun in apposition.

Distribution (Fig. 1). Halmahera (Moluccas, Indonesia).

***Drepanosticta moluccana* group**

***Drepanosticta amboinensis* van Tol, sp. n.**

Figs 1, 45-50

Platysticta bicornuta. - Ris, 1915: 89 (1 female, Ceram)

[misidentification, fide Liefstinck, 1949]

Drepanosticta auriculata. - Ris, 1929: 141-142 (Ceram only).

Drepanosticta moluccana Liefstinck (female Ceram only). - Liefstinck, 1949: 82.

Type material. Holotype male [JvT 23556]: 'S. Moluccas / Ambon x.1949 / M.A. Liefstinck' [printed label with black border], and 'Ambon 12.10.49' [hand written, in purple], and '*Drepanosticta* sp. n.' [in Liefstinck's hand].

Paratypes (all Ambon): Ambon, 5 Nov 1948, 5 males 2 females [235548-23554]; same data as holotype, 4 males [JvT 23555, 23557-9]; as holotype, but date 9 Oct 1949, 1 male 1 female [JvT 23560-1]; Ambon island, mountain brook, 150 m, 20 Apr 1961, A.M.R. Wegner, 1 male [JvT 23562]; Mt Salahuhi, 600 m, 26 Oct 1961, 1 female [JvT 23563].

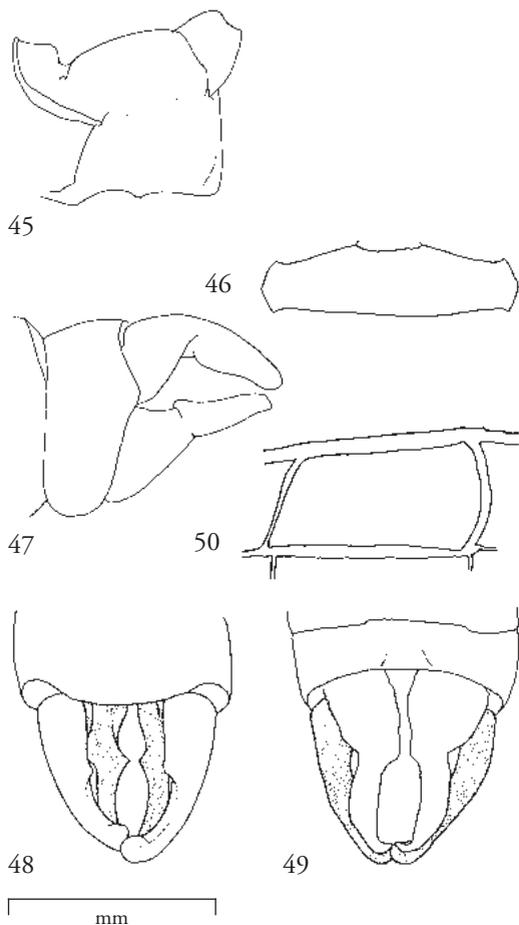
Other material (excluded from type series). Ceram, 1 female (see Ris, 1915) [not studied, doubtfully conspecific].

Structurally similar to *D. moluccana* Liefstinck, but synthorax without distinct pale metepisternum and metepimeron, presumably not due to preservation conditions; the inferior appendages lack the subterminal constriction, as present in *D. moluccana* and *D. obiensis* sp. n.

Male [holotype, JvT 23556]. Head. As *D. moluccana* (see below), but pale markings of mandibles and labrum bluish white; anterior one-third of labrum dark; pale stripe over frons similar as in *D. moluccana*. Thorax. Pronotum (Figs 45-46) as in *D. moluccana*, but somewhat darker. Synthorax much darker, paler stripes over metepisternum and metepimeron hardly recognizable; legs somewhat paler. Wings hyaline, venation brown; Px in fore wing 16, in hind wing 15; R4+5 arising just anterior to nodus; IR3 arising halfway first cell distal to subnodus; Ab vein meeting Ac at hind margin of wing (Y sessile); CuP reaching hind margin of fore wing at level of Px 4, in hind wing at level of Px 6; ten cells between Arculus and place where CuP meets hind margin of hind wing; pterostigma (Fig. 50) rather dark, otherwise as in *D. moluccana*.

Abdomen. Generally darker than *D. moluccana*, but last segment paler; anal appendages (Figs 47-49) dirty yellow, the top of inferiors somewhat different from *D. moluccana*, in ventral view without distinct subterminal constriction, although tip turned inward and somewhat dorsad.

Female. Similar to the male; pale markings of abdomen more extensive; last abdominal segments short; valves and terebra short, not surpassing level of anal appendages.



Figures 45-50. *Drepanosticta amboinensis* sp. n., male. – 45, pronotum, left lateral view. – 46, posterior lobe of pronotum, dorsal view. – 47, anal appendages, left lateral view. – 48, idem, dorsal view. – 49, idem, ventral view. – 50, pterostigma, right fore wing.

Measurements. Male, abdomen including anal appendages 35 mm, hind wing 23 mm; female, abdomen 31 mm, hind wing 24 mm.

Eymology. *Amboinensis* (L.), for the type locality, the island of Amboina (Ambon). An adjective.

Remark. It is uncertain whether the female from Seram, mentioned since Ris (1915) under various names, is indeed conspecific with the specimens from Ambon.

Distribution (Fig. 1). Ambon (southern Moluccas, Indonesia), and possibly Seram.

Drepanosticta moluccana Liefstinck

Figs 1, 51-56

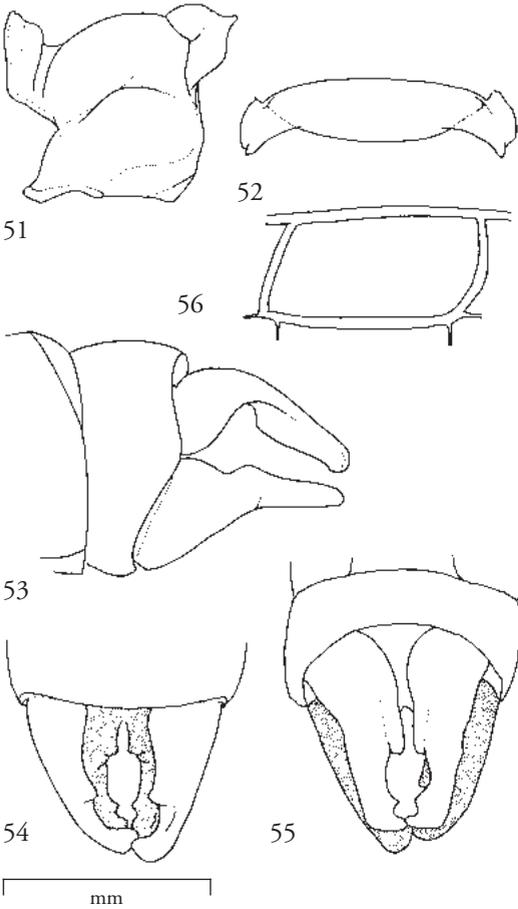
Drepanosticta auriculata (partim). – Ris, 1929: 141–142 (Buru only).

Drepanosticta moluccana Liefstinck, 1938: 82-83 (original description [as 'nom. nov'] for specimens of *D. auriculata* from Buru).

Medium-sized *Drepanosticta*, brown with paler markings on synthorax and abdomen; pronotum without posterior processes, appendages short and simple; inferior appendages in ventral view rather stout, the terminal part c. two times as long as wide, subterminally with distinct constriction; the closely related *D. obiensis* sp. n. with more slender inferior appendages.

Male [based on JvT 21410]. Head. Labrum, mandibles and anteclypeus bluish white, labrum with anterior two-fifths brown, mandibles with anterior one-sixth brown; gena pale, rest of head variegated with brown; a narrow transverse paler brown stripe over frons between antennae just in front of anterior ocellus; postocular lobe and occiput pale brown; fine longitudinal striae between eye and ocelli, rest of head coriaceous; transverse occipital carina poorly developed, without extremities. Antennae with scapus pale brown, pedicellus brown, anteriorly black, flagellum brown.

Thorax. Pronotum (Figs 51-52) predominantly pale brown, but lateral lobe darker; lateral parts of anterior lobe and median lobe paler, anterior lobe simple, erect, but anterior border not widening, posterior lobe simple as well, the lateral parts with sharp edge in line with median portion, laterally rounded ventrad. Synthorax dorsally medium brown, dorsal carina paler, dark stripe over dorsal half of mesepisternum against dorsal carina; metepisternum ivory white and metepimeron dirty yellow, a stripe over metapleural suture distinctly darker. Legs dirty yellow, dark rings on femora of all legs as follows: an inconspicuous ring close to coxa, a more distinct ring at one-third the femur-length from tibia, and a narrow ring at joints with tibiae. Wings hyaline, venation middlebrown, Costa darker; Px in fore wing 17, in hind wing 16; R4+5 arising



Figures 51-56. *Drepanosticta moluccana* Lieftinck, male. – 51, pronotum, left lateral view. – 52, posterior lobe of pronotum, dorsal view. – 53, anal appendages, left lateral view. – 54, idem, dorsal view. – 55, idem, ventral view. – 56, pterostigma, right fore wing.

at nodus (hind wing) or well anterior to nodus (fore wing); IR3 arising halfway first cell after subnodus; Ab vein meeting Ac at or just before hind margin of wing (Y sessile or very short-stalked); CuP reaching hind margin of wing at level of Px4 in fore wing, at level of Px5 in hind wing; nine cells between Arculus and place where CuP meets hind margin of hind wing; pterostigma (Fig. 56) castaneous, proximal side oblique, distal side somewhat convex, c. 1.8 times as wide as high; cells distal to pterostigma undivided. Abdomen. Segment 1 somewhat expanded posteriorly, pale brown, but with small triangular dark marking

near annule with segment 2; segment 2 brown, antero-lateral corner pale; segments 3-5 anterior three-quarters pale brown (middle part dark than rest, and anteriorly paler), rest of segments dark brown, but somewhat variable; segment 6 anterior one-fifth dirty yellow, rest brown to brownish black against segment 7; segment 7 dark brown, but somewhat paler in latero-anterior one-fourth; segments 8-9 dark mat-brown; segment 10 paler, shining. Anal appendages (Figs 53-55) ochreous; superiors in dorsal view curved inward, with small flat dorsal tubercle at half the appendage length, distal half dorso-ventrally compressed, elongate club-shaped; inferiors with distal half parallelsided, the tip constricted, compressed and turned dorsad.

Female. Only known specimen damaged.

Measurements. Male, abdomen including appendages 36 mm, hind wing 24 mm.

Material examined. All specimens from Buru (in RMNH). Nal'besi, 26 Apr 1921, L. J. Toxopeus, 1 male [holotype, JvT 3049]; Leksoela, Aug 1921, 1 male [JvT 14740]; Buru Station 2, L.J. Toxopeus, 1 female, [JvT 19948]; Leksoela, 8 Nov 1941, J. J. van der Starre, 4 males [JvT 19892-4, 21410].

Remark. Toxopeus (1924) includes ecological data of the locality. Buru station 2 is described as follows: '... a fairly big waterfall called the Wa'ha (in Malay: Air Berbunyi, i.e. Thundering Water). This stream springing from the rocks at about 1300 ft is powerfully fed by subterranean channels and at a height of some 650 ft the falls begin in successive cascades . . . '.

Distribution (Fig. 1). Buru (Moluccas, Indonesia).

***Drepanosticta obiensis* van Tol, sp. n.**

Figs 1, 57-62

Type material. – Holotype male [JvT 23567] 'Obi, Kali Telaga, 6 Aug 1953' [leg. A. M. R. Wegner]. Paratypes [all in RMNH]. Obi, Kali Telaga, 6 Aug 1953, [leg. A.M.R. Wegner], 3 males [JvT 23564-6]; same 31 Oct 1953, 2 males [JvT 23568-9]; same, 2 Nov 1953, 2 males 1 female [JvT 23570-2]; Obi, Laiwui, 21 Oct 1953, 1 male [JvT 23573].

In general, structurally similar to *D. moluccana*, but pale stripes over metepisternum and metepimeron less conspicuous, the dark stripe over metapleural suture narrower; abdomen generally paler; inferior appendages in ventral view subterminally distinctly constricted, the terminal part slender, more than two times as long as wide.

Male [holotype, JvT 23567]. Head. Mandibles and labrum bluish white, anterior two-fifths of labrum dark.

Thorax. Pronotum (Figs 57-58) not conspicuously different from *D. moluccana*. Synthorax with metepisternum and metepimeron dark yellow, a narrow dark stripe over metapleural suture. Legs dirty yellow, the dark rings very conspicuous. Wings hyaline, venation brown, Costa brownish black; number of Px in fore wing 17, in hind wing 16; R4+5 arising at nodus, IR3 arising halfway first cell distal to subnodus; Ab vein meeting Ac before hind margin of wing (Y-vein short-stalked); CuP reaching hind margin of fore wing at level of Px4, of hind wing at level of Px6; ten cells between Arculus and place where CuP meets hind margin of hind wing; pterostigma (Fig. 62) castaneous; many cells distal to pterostigma divided. Abdomen rather pale, segment 1 brown, segment 2 brown, except for a pale triangular spot in lateroanterior corner, segment 3 with anterior one-eighth dirty yellow, broken by dark line in middle, then posteriorly three-eighths brown (anterior and posterior parts paler), posterior-most one-quarter dark brown, a pale brown region between both dark rings; segments 4-5 with similar markings, but pale area between dark rings much darker, nearly brown on segment 5; segments 6-7 with anterior one-fourth pale, especially on segment 7 broken by dark median line; segments 8-10 dark. Anal appendages (Figs 59-61) ochreous, similar to *D. moluccana*, but medio-dorsal tooth on superiors more distinct and sharper, inferiors as in *D. moluccana*, but more slender.

Female: As male, but rather pale; valves and terebra approximately as long as anal appendages.

Measurements. Male, abdomen including appendages 33 mm, hind wing 20.5 mm; female abdomen 32 mm, hind wing 23 mm.

Etymology. *Obiensis* (L.), for the type locality. An adjective.

Distribution (Fig. 1). Obi (Moluccas, Indonesia).

Drepanosticta robusta Fraser

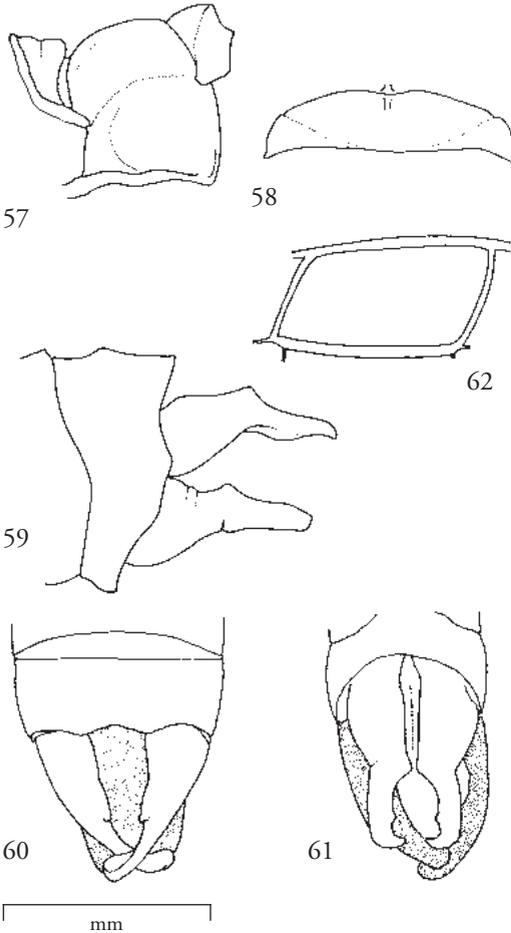
Fig. 1

Drepanosticta robusta Fraser, 1926: 491-492 (original description, Kei Island, Gn Daab). – Liefinck, 1971: 110 (lectotype female in RMNH).

As already indicated in the original description, the male is teneral, incomplete (missing abdominal segments 7-10) and in poor condition. Although the pronotum is much distorted, it seems that the structure of the hind margin of the posterior lobe of the pronotum resembles the species of the *D. moluccana*-group; also the smoothly rounded transverse occipital carina, and the transverse pale stripe over the vertex indicate a close relationship to *D. moluccana*. The female lectotype is in good condition, and is presumably conspecific; generally pale brown, distinct transverse paler stripe between antennae, transverse occipital carina indistinct, lateral extremities absent; pronotum with hind margin posterior lobe rounded without posterior processes; metepimeron and metepisternum very pale.

Male [based on paralectotype, JvT 15407]. Head. Labrum, mandibles and anteclypeus dirty white, without dark anterior border [possibly due to teneral state]; remaining part of head brown, with broad pale stripe between antennae, also covering anterior half of median ocellus; an oval marking abaxially of lateral ocelli, somewhat larger than the ocelli; occiput also paler than rest of head; transverse occipital carina hardly visible, no lateral extremities.

Thorax. Pronotum simple, brown; anterior lobe simple, with anterior margin erect, without distinct extensions; posterior lobe short, with very short triangular projections on hind margin, c. one-fourth the



Figures 57-62. *Drepanosticta obiensis* sp.n., male. – 57, pronotum, left lateral view. – 58, posterior lobe of pronotum, dorsal view. – 59, anal appendages, left lateral view. – 60, idem, dorsal view. – 61, idem, ventral view. – 62, pterostigma, right fore wing.

length of the posterior lobe itself. Synthorax (damaged) brown, with presumably distinct pale stripe over metepisternum, and another stripe over metepimeron, divided by a narrow brown stripe over metapleural suture. Legs (only right middle leg available) yellow. Wings hyaline, venation pale brown, Px in fore wing 16, in hind wing 15; R4+5 arising at nodus, IR3 arising halfway first cell distal to subnodus; Arculus distal to Ax2; Ab vein meeting Ac well before hind margin of wing (Y-vein stalked); number of cells between Arculus and place where CuP meets hind margin of hind wing

10; CuP meets hind margin of fore wing at level of Px5; of hind wing at level of Px6; pterostigma pale brown, trapezoidal, only distal side somewhat convex; some cells distal to pterostigma divided.

Abdomen (broken at base of segment 4). Pale brown with extensive dirty yellow markings.

Female [lectotype]. Head. Labrum, anteclypeus and mandibles dirty yellow; anterior one-third of labrum indistinctly castaneous, mandibles with very narrow brownish black anterior border; rest of head dark brown, but indistinct brown transverse stripe between antennae before median ocellus; transverse occipital carina indistinct, lateral extremities absent. Antenna with scapus brownish black, pedicellus brown, flagellum brown.

Thorax. Pronotum pale brown to dirty yellow, lateral lobes somewhat darker; anterior lobe simple, without broader parts; posterior lobe very short, without posterior projections. Synthorax predominantly pale ochreous brown; mesepimeron pale brown, dorsal carina not darker, but mesopleural suture with narrow, distinct mat-black stripe ending just before posterior margin of synthorax; mesepisternum brownish black, upper and lower sides over sutures darker, posteriorly with indistinct elongate triangular paler marking; metepimeron and metepisternum pale ochreous brown, but metapleural suture with narrow, but distinct, black stripe. Legs dirty yellow, but dark rings on tibiae against joints with femora. Wings hyaline, venation brown; Px in fore wing 15, in hind wing 14; R4+5 arising at nodus; IR3 circa halfway first cell distal to subnodus; Arculus just distal to Ax2; Ab vein meets Ac well before hind margin of wing (Y-vein short-stalked); CuP meeting hind margin of fore wing at level of Px4, of hind wing at level of Px6; number of cells between Arculus and place where CuP meets hind margin of fore wing 9, of hind wing 10; pterostigma somewhat wider than high; veins distal to pterostigma undivided. Abdomen pale brown, with dirty yellow markings as follows: segment 1 lateral third on both sides, segment 2 latero-anterior one-fourth indistinctly paler; segment 3 anterior one-third; segment 4 anterior one-fifth; segments 5-6 anterior one-fourth, all dorso-medially

interrupted by longitudinal dark stripe; segments 7-10 castaneous, valves somewhat darker; valves and terebra long, extending well beyond anal appendages.

Measurements. Male. Abdomen including anal appendages (not measurable), hind wing 23 mm; female abdomen 33 mm, hind wing 24 mm.

Material examined. Lectotype female: 'H.C. Siebers/Kei Eil. 1922/Gn. Daab 149' [printed label, but '149' handwritten]. Paralectotype: Kei Islands, Gn Daab, 1922 (H. C. Siebers), 1 male (teneral and incomplete, with label *Drepanosticta robusta* male sp. nov. [Fraser's hand]).

Distribution (Fig. 1). Kei Island (Moluccas, Indonesia).

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References

- Asahina, S. 1984. A list of the Odonata from Thailand. Part III. Platystictidae. – *Kontyû* 52: 585-595.
- Calvert, P. P. 1931. The generic characters and the species of *Palaemnema* (Odonata: Agrionidae). – *Transactions of the American Entomological Society* 57: 1-110.
- Cowley, J. 1936. Descriptions of three new species of *Drepanosticta* (Odonata) from the Philippine islands. – *Transactions of the Royal Entomological Society of London* 85: 157-167.
- De Jong, R. 1998. Halmahera and Seram: different histories, but similar butterfly faunas. – In Hall, R. & Holloway, J. D. (eds). *Biogeography and geological evolution of SE Asia*: pp. 315-325. Backhuys Publishers, Leiden.
- Fraser, F. C. 1926. Notes on a collection of dragonflies (Order Odonata) from the Dutch East Indies and descriptions of four new species from the neighbouring continent. – *Treubia* 8: 467-494.
- Gassmann, D. 1999. Taxonomy and distribution of the *inornata* species-group of the Papuan genus *Idiocnemis* Selys (Odonata: Zygoptera: Platycnemididae). – *Invertebrate Taxonomy* 13: 977-1005.
- Gassmann, D. 2000. Revision of the Papuan *Idiocnemis bidentata*-group (Odonata: Platycnemididae). – *Zoologische Mededelingen* 74: 375-402.
- Gassmann, D. 2005. The phylogeny of Southeast Asian and Indo-Pacific Calicnemiinae (Odonata, Platycnemididae). – *Bonner Zoologische Beiträge* 53: 37-80.
- Gassmann, D. & Hämäläinen, M. 2002. A revision of the Philippine subgenus *Risioicnemis* (Igneocnemis) Hämäläinen (Odonata: Platycnemididae). – *Tijdschrift voor Entomologie* 145: 213-266.
- Hall, R. 2002. Cenozoic geological and plate tectonic evolution of SE Asia and the SW Pacific: computer-based reconstructions, model and animations. – *Journal of Asian Earth Sciences* 20: 353-431.
- Hämäläinen, M. 1999. *Drepanosticta jurzitzai* spec. nov., a new damselfly from southeastern Thailand (Zygoptera: Platystictidae). – *Odonatologica* 28: 421-423.
- Hill, K. C. & Hall, R. 2003. Mesozoic–Cenozoic evolution of Australia's New Guinea margin in a west Pacific context. – *Geological Society of America, Special Paper* 372: 265-290.
- Lieftinck, M. A. 1938. The dragonflies (Odonata) of New Guinea and neighbouring islands. Part V. Descriptions of new and little known species of the families Libellaginidae, Megapodagrionidae, Agrionidae (sens. lat.), and Libellulidae (Genera *Rhinocephya*, *Argiolestes*, *Drepanosticta*, *Notoneura*, *Palaiaargia*, *Papuaargia*, *Papuaargrion*, *Teinobasis*, *Nannophlebia*, *Synthemis*, and *Anacordulia*). – *Nova Guinea (New Series)* 2: 47-128.
- Lieftinck, M. A. 1949. The dragonflies (Odonata) of New Guinea and neighbouring islands. Part VII. Results of the Third Archbold expedition 1938–1939 and of the Le Roux Expedition 1939 to Netherlands New Guinea (II. Zygoptera). – *Nova Guinea (New Series)* 5: 1-271.
- Monk, K. A., de Fretes, Y. & Reksodiharjo-Lilley, G. 1997. *The ecology of Nusa Tenggara and Maluku*. – The ecology of Indonesia series. Volume 5. Singapore (Periplus Editions): i-xvii, 1-966.
- Polhemus, D. A. 1995. Two new species of *Rhagovelia* from the Philippines, with a discussion of zoogeographic relationships between the Philippines and New Guinea (Heteroptera: Veliidae). – *Journal of the New York Entomological Society* 103: 55-68.

- Pubellier, M., Quebral, R., Aurelio, M. & Rangin, C. 1996. Docking and post-docking escape tectonics in the southern Philippines. – In Hall, R. & Blundell, D. Tectonic evolution of Southeast Asia: pp. 511-523. Geological Society Special Publication 106.
- Ris, F. 1913. Odonata von den Aru- und Kei-Inseln gesammelt durch Dr. H. Merton 1908 nebst Übersicht über die von den Aru-Inseln bekannten Odonaten. – Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft 34: 503-537 + plate 23.
- Ris, F. 1915. Neuer Beitrag zur Kenntnis der Odonaten-Fauna der Neu-Guinea-Region. – Nova Guinea (Zoologie) 13 (2): 81-131.
- Ris, F. 1929. Fauna Buruana. Odonata gesammelt von L.J. Toxopeus auf Buru, 1921–1922, nebst einigen Odonaten von Amboina. (2. Teil, Zygoptera). – Treubia (Suppl.) 7: 139-147.
- Theischinger, G. & Richards, S. J. 2005. Two new species of *Drepanosticta* Laidlaw from Papua New Guinea (Zygoptera: Platystictidae). – Odonatologica 34: 307-312.
- van Tol, J. 2005. Revision of the Platystictidae of the Philippines (Odonata), excluding the *Drepanosticta halterata* group, with descriptions of twenty-one new species. – Zoologische Mededelingen 79 (2): 195-282.
- van Tol, J. 2006. Catalogue of the Odonata of the World (version 1.1., November 2005). In Bisby, F. A., Ruggiero, M. A., Roskov, Y. R., Cachuela-Palacio, M., Kimani, S. W., Kirk, P. M., Soulier-Perkins, A. & van Hertum, J. (eds). Species 2000 & ITIS Catalogue of Life: 2006 Annual checklist. CD-ROM, Reading, U.K. (Species 2000). [Recent versions on <http://www.odonata.info>].
- van Tol, J. 2007. The Odonata of Sulawesi and adjacent islands. Part 6. Revision of the genus *Drepanosticta* Laidlaw (Platystictidae). – Odonatologica 36: 171-189.
- van Tol, J. & Gassmann, D. 2007. Zoogeography of freshwater invertebrates of Southeast Asia, with special reference to Odonata. – In Renema, W. (ed.). *Biogeography, Time and Place: Distributions, Barriers and Islands* Dordrecht (Springer). [Chapter 2].
- Toxopeus, L. J. 1924. A short description of the localities on the island of Buru, in the Moluccas, where zoological collections were made during a scientific expedition in 1921 and 1922. – Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap 41: 7-18. [An additional map with the collecting stations published as Bulletin Maatschappij ter Bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën, no. 80].
- Vane-Wright, R. I. & Peggie, D. 1994. The butterflies of Northern and Central Maluku: diversity, endemism, biogeography, and conservation priorities. – Tropical Biodiversity 2: 212-230.
- Watson, J. A. L. & O'Farrell, A. F. 1991. Odonata. In Naumann, I. D. et al. (eds). The insects of Australia: pp. 294–310. 2nd Edition, Canberra (CSIRO).
- Wilson, K. D. P. 1997. The Platystictidae of Hong Kong and Guangdong, with descriptions of a new genus and two new species (Zygoptera). – Odonatologica 26: 53-63.
- Wilson, K. D. P. & Reels, G. T. 2001. Odonata of Hainan, China. – Odonatologica 30: 145-208.
- Wilson, K. D. P. & Reels, G. T. 2003. Odonata of Guangxi Zhuang autonomous region, China, part 1: Zygoptera. – Odonatologica 32: 237-279.

