

The Butterflies of the Genus *Delias* Hübner (Lepidoptera: Pieridae) in the Pass Valley, Papua, Indonesia

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Abstract: The records of *Delias* species encountered by the author and his assistants are presented in this paper, showing quite some differences with the records from the very close Baliem Valley. On the other hand a link is suggested with *Abmisibil* in the Star Mountains. Additionally, some notes and comments are made on individual species, including a syn. nov.

Rangkuman: Hasil penangkapan *Delias* oleh pengarang dan pembantu-pembantunya disajikan, menunjukkan adanya perbedaan dengan hasil dari Lembah Baliem yang letaknya sangat dekat. Dari segi lain diduga adanya hubungan dengan daerah *Abmisibil* di Pegunungan Bintang. Akhirnya diberikan sejumlah catatan dan komentar bertalian dengan beberapa spesies, termasuk satu syn. nov.

Key-words: Diversity, frequency, New Guinea, syn. nov.

Introduction

In SUGAPA 5(2) van Mastrigt (2011a) compared records of the *Delias* species from the Baliem Valley (1,600 m) extending to Lake Habbema at the foot of the Mt Trikora (3,300 m) with those of the Archbold III Expedition in the same area. In this article, collecting results are presented from the so called "Pass Valley" area, north of the Baliem Valley, recorded by the author and local assistants from roughly four localities, in the period 1987-1998.

The Pass Valley area

Leaving Wamena in the direction of Pass Valley (north east of Wamena), the road leads through the valley to Jiwika (17 km) and Waga-Waga (25 km) before turning in to mountainous areas to the NE. At kilometre 37, where the road is very steep,

the River Sowagi (Sowage) is crossed. Sixteen to twenty kilometres further on is Watlangku area, with a river of the same name. At kilometre 67, the village of Abeneho, with an airstrip named Pass Valley (E 139°05.913'; S 3°51.516' at 1,850 m), is reached. In this area are the rivers Bion, Ibem, and Bi(k), which were –and hopefully still are– excellent places for observing and recording *Delias*. From there a two-three hours downhill walk reaches the River Ameagi at about 1,450 m. altitude.

Actual status and forms

Only three species need some comments concerning status and forms. Within *D. hypomelas* two forms are recognized (one with yellow subapical spots, the other with red ones); within *D. argentata* also two forms with the same characteristic features as in *hypomelas* and within *D. nais* form *zebra* is included with all its varieties in between.

Results of collecting by Henk van Mastrigt

In the above mentioned areas over a period of about ten years, with very frequent visits initially (from 1991–1993) and occasional ones later, 39 species of the genus *Delias* were recorded, nine more than the number of *Delias* in the Baliem Valley and environs, even though the extent of the collecting area is not much different and the range of altitudes is less: the Pass Valley collecting locations range from 1,450 m to 1,840 m, in the Baliem Valley and environs collections were made from 1,600 m to 3,000 m.

The recorded species will be analysed from two points of view. First the diversity, of species at each locality is assessed and compared with adjacent localities. Secondly, attention is paid to the population frequencies of the various species. Finally some notes about individual species are presented.

Species diversity

The 39 species of *Delias* found in the whole area of the Pass Valley (represented by 22,645 specimens), consists of 26 of the 30 species found in the Baliem Valley and environs (no records were made of *aruna inferna*, *rileyi*, *leucobalia* and *arabuana*) and 13 species not recorded in the Baliem Valley and upwards: *mavroneria*, *ladas*, *destrigata*, *geraldina*, *subapicalis*, *oktanglap*, *langda*, *awongkor*, *isocharis*, *campbelli*, *roepkei michiae*, *fioretti* and *telefominensis*. In the text below we will consider the species richness at the four separate localities.

At the **Suwagi River** (KM 37) thirty species were recorded in 56 collecting days, the same number as the records in the Baliem Valley and upwards. (See van

Mastrigt, 2010a) - Compared to the Baliem, no records were made of *aruna inferna*, *rileyi*, *leucobalia*, *arabuana*, and *ligata*, but additional records were made of *ladas*, *subapicalis*, *oktanglap*, *langda*, *campbelli*, –outside the used collection days– a single *fioretti*.

At the **Watlangku River** the number of species reduced to 27, collected in 16 days: four species that occur at the Suwagi River were not found: *carstensziana*, *luctuosa*, *roepkei michiae* and *walshae*; however *ligata* also present in the Baliem Valley, was a new record in comparison with Suwagi.

In **the Bion area**, the species richness is the highest: no less than 34 species were recorded in 149 collecting days. Only five species were lacking from the 39 species found in the entire Pass Valley area: *mavrneria*, *geraldina*, and *telefominensis* were only recorded along river Ameagi at 1,450 m, *argentata* which was replaced by a single specimen of *destrigata* and *autumnalis*, the only species recorded at all localities, except in the environment of the Bion. The striking *D. fioretti* is endemic in the Pass Valley area. The records were in the beginning only from the rivers Bion and Ibem; one specimen is known from Suwagi. However, on all localities it is very rare and on the most recent visits after 2004, the species has not been recorded again.

The **Ameagi River** quite differs from three other localities, because of the altitude of the side at only 1,450 m. The presence of *mavrneria* and *geraldina* is not surprising for this altitude. The records of *D. telefominensis* –previously only known from the Star Mountains, where it is recorded at Telefomin (P.N.G.) and at Abmisibil (Papua, Indonesia), from where the female is known–, the dominant presence of *toxopei* and the single specimen of *destrigata* were notable records from this site, collected over a period of 26 days.

Species frequency

The results of the Baliem Valley show that at every locality and altitude three species are numerically dominant, representing over 50% of all specimens. This pattern is absent in the Pass Valley area where the three most common species (*hypomelas* 10.12%, *niepelti* 10.00% and *leucias* 9.97%) amount to only 30.09% of the total population. Four additional species are needed to pass the 50% mark, *alepa* 6.51%, *fascelis* 6.26%, *approximata* 5.99% and *microsticha* 5.35%; thus 7 species represent 54.20% all records.

At River Suwagi the three most common species (*fascelis* 10.73%, *flavistriga* 9.64% and *approximata* 9.58%) amount to 29.95% of records and three more species (*leucias* 8.13%, *nais* 7.97% and *niepelti* 6.65%) are needed to bring the total to 52.70%. At River Watlangku the three most common species (*niepelti* 12.15%, *hypomelas* 9.87% and *oktanglap* 9.43%) amount to 31.45% and three more species (*callista* 9.09%, *approximata* 7.44% and *leucias* 7.39%) are needed to raise the total to 55.37%.

At the River Bion area the three most common species (*hypomelas* 12.11%, *leucias* 11.43%, *niepelti* 10.90%) amount to 34.44% and only two more species (*oktanglap* 9.52% and *alepa* 7.24%) are needed to raise the total to 51.20%.

At River Ameagi the three most common species (*toxopei* 13.89%, *microsticha* 11.24% and *hypomelas* 10.72%) reach 35.85% and three more species (*nais* 7.32%, *niepelti* 5.53% and *hapalina* 4.96%) are needed to lift the total to 53.66%.

One species (*hypomelas*) is at three locations among the three most common species; *niepelti* is twice in this category.

Notes on some species

D. callima telefominensis Yagishita, 1993 was described from a single male, recorded at Telefomin, WSP, PNG in the eastern part of the Star Mountains, in August, 1968. Van Mastrigt, 1996b, after studying one more specimen (in GG) and records from Abmisibil, (in RMNH and KSP), including a female, raised *telefominensis* to specific rank, based on the distance between *callima* and *telefominensis* and the *telefominensis* female, which does not have any resemblance with the female of *callima*. Sakuma (1996) described *D. telefominensis ayamiae* which will be proposed to be a synonym of *D. telefominensis*.

It should be notified that *telefominensis* is a very rare and possibly local species in the Star Mountains. The records along the River Ameagi by the author and his assistants (61 males in 28 days), being 3.52% of all *Delias* put it on the 13th place in frequency of the 33 species recorded.

D. hypomelas*, *D. argentata* and *D. destrigata belong still to the most exciting records. Moving from the Baliem Valley to River Ameagi, it is evidently shown how the frequency of *argentata* is decreasing via Suwagi (7.55%) and Watlangku (0.39%) to zero in the environs of River Bion and at the borders of River Ameagi. At the same time the opposite is shown with *hypomelas*: 0.36% at Suwagi, 9.87% at Watlangku, 12.11% in the environs of River Bion and 10.72% at River Ameagi. At River Bion and at River Ameagi (where *argentata* is absent) *D. destrigata* was recorded. In *hypomelas* from Suwagi some reddish streaks are present on the underside of hindwing; however, all specimens from Watlangku, Bion area and Ameagi are black. An DNA-study on these three taxa will probably answer the question on the true relationship between these taxa.

D. subapicalis is with 698 records, including two females not a rare species (3.04%), best represented at River Suwagi, where 174 males and 1 female were recorded (5.29%).

D. oktanglap nishiyamai was described by Yagishita (1993) based on three males from Pass Valley. Gerrits & van Mastrigt [1992] described *D. langda langda* based on 28 males from Langda (in southern part of central mountain range at 140° EL), and ***D. langda watlangku*** based on 228 males from Pass Valley, (NE of Baliem

Valley at about 139°06'EL). The high frequency of *oktanglap* (6.26%) and *langda* (3.15%) was a breal surprise in comparison with the records at Langda and Abmisibil. It is not precluded that *langda* is only a very dark form of *oktanglap*. More records—including a female—and an intensive study could probably solve this problem. ***Delias antara solana*** Morinaka & Nakazawa, 1997 is a rare species in Pass Valley (excluding Suwagi) were its presence varies from 0.09% in the environs of River Bion to 0.23% at River Ameagi.

D. germana germana is even less frequent with no records at Ameagi to 0.15 at Watlangku.

The records of ***D. nais*** and ***D. zebra*** in this area, with a majority of mixed forms, recently brought Katsuyuki (2010) to synonymize *D. zebra* with *D. nais*, a step which had already been suggested by Parsons (1990).

The three records of ***D. awongkor*** were really unexpected, as this species was described when thought to be endemic in the Star Mts. The presence at Walmak did already show its presence in more western areas.

D. wollastoni (*abmisibilensis*) is accepted to be a mountane species. Therefore its higher frequency at the lower River Ameagi (0.23%) is quite surprising in comparison with only 0.03% in the environs of River Bion. Also at River Suwagi (0.21%) and at Watlangku (0.15%) its frequency is lower that at River Ameagi.

D. roepkei cieko Arima, 1996 is another exciting species at Pass Valley, not only because is it a quite rare and nice species, but also because it appears in for different form as described by Van Mastrigt (2000).

Delias autumnalis michiae Nakano, 1994 and ***D. fioretti*** Van Mastrigt, 2000 are two rare species from the Pass Valley area; ***fioretti***—as stated above— was not recorded any more after 1994.

D. campbelli is the only species of which I recorded much more females (40) than males (7) in Pass Valley; i.e. 85% females of the 47 records. The second common female is of *D. nais* with 105 females and 721 males (12.7%). The total number of females (321) is only 1.40% of all records in Pass Valley. The only reason for the high number of *campbelli* females is probably that the females live at the top altitude of the species (as many in many *Delias*), while males go down till 900 m.

Discussion

There is a striking connection between the specimens in the Pass Valley area (in the northern side of the central mountain range) and those of Abmisibil in the northern side of the Star Mountains, which becomes evident by the presence of *telefominensis*, *subapicalis*, *oktanglap*, *awongkor*, *wollastoni abmisibilensis* and *roepkei*; all these six species are absent in the Baliem Valley. As far as *subapicalis*, *oktanglap* and *wollastoni abmisibilensis* concerned, this connection could be via Korupun and Langda,

however these villages are situated in the south side of the central mountain range. The fact that the River Baliem in the past flowed to the north and only since three or four ages to the south after a huge earth quake, could be a reason why the fauna in the Baliem Valley has been changed (in comparison with Pass Valley), after the river rushed to the south. Standing in the middle of the Valley, people will see hills in the north-west and a huge, rough mountain range in the south, a sight which talks about history.

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Table 1. Results on *Delias* by Henk van Mastrigt c.s. from Pass Valley

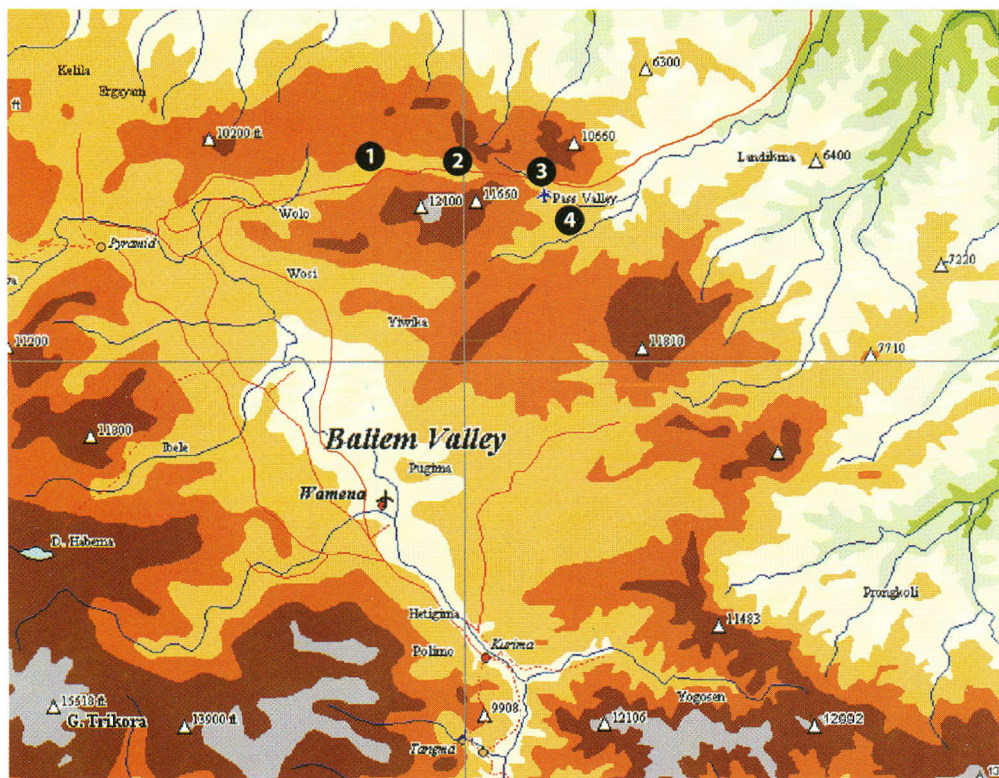
No	Daerah	Suwagi				Watlangku			
	Pass Valley/Days	56				16			
		M	F	M+F	%	M	F	M+F	%
1	<i>telefominensis</i>	-	-	-	-	-	-	-	-
2	<i>ladas</i>	5	-	5	0.15	2	1	3	0.15
3	<i>microsticha</i>	84	-	84	2.54	79	-	79	3.84
4	<i>rileyi</i>	-	-	-	-	-	-	-	-
5	<i>hypomelas</i> yellow	9	-	9	0.27	195	5	200	9.72
	<i>hypomelas</i> red	3	-	3	0.09	3	-	3	0.15
6	<i>argentata</i>	62	-	62	1.87	1	-	1	0.05
	<i>argentata</i> f. <i>sanguinea</i>	188	-	188	5.68	7	-	7	0.34
7	<i>destrigata</i>	-	-	-	-	-	-	-	-
8	<i>approximata</i>	316	1	317	9.58	153	-	153	7.44
9	<i>yabensis</i>	1	-	1	0.03	25	1	26	1.26
10	<i>subapicalis</i>	174	1	175	5.29	58	-	58	2.82
11	<i>fascelis</i>	355	-	355	10.73	134	-	134	6.51
12	<i>oktanglap</i>	125	-	125	3.78	194	-	194	9.43
13	<i>langda</i>	70	-	70	2.12	68	-	68	3.31
14	<i>carstenziana</i>	4	-	4	0.12	-	-	-	-
15	<i>antara</i>	179	-	179	5.41	3	-	3	0.15
16	<i>germana</i>	29	-	29	0.88	3	-	3	0.15
17	<i>catisa</i>	149	-	149	4.50	22	-	22	1.07
18	<i>toxopei</i>	20	-	20	0.60	49	-	49	2.38
19	<i>leucobalia</i>	-	-	-	-	-	-	-	-
20	<i>callista</i>	27	1	28	0.85	184	3	187	9.09
21	<i>arabuana</i>								
22	<i>flavistriga</i>	318	1	319	9.64	68	-	68	3.31
23	<i>awongkor</i>	-	-	-	-	-	-	-	-
24	<i>luctuosa</i>	1	-	1	0.03	-	-	-	-
25	<i>leucias</i>	269	-	269	8.13	152	-	152	7.39
26	<i>rosamontana</i>	131	-	131	3.96	58	-	58	2.82
27	<i>hapalina</i>	74	2	76	2.30	117	3	120	5.83
28	<i>nais</i>	13	2	15	0.45	28	2	30	1.46
	<i>nais</i> f. <i>zebra</i>	234	15	249	7.52	18	-	18	0.88
29	<i>klossi</i>	49	2	51	1.54	21	-	21	1.02
30	<i>wollastoni</i>	7	-	7	0.21	3	-	3	0.15
31	<i>roepkei michiae</i>	4	-	4	0.12	-	-	-	-
32	<i>autumnalis</i>	8	-	8	0.24	2	-	2	0.10
33	<i>walshae</i>	24	-	24	0.73	-	-	-	-
34	<i>fioretti</i>	-	-	-	-	-	-	-	-
35	<i>isocharis</i>	-	-	-	-	-	-	-	-
36	<i>ligata</i>	-	-	-	-	8	3	11	0.53
37	<i>niepelti</i>	217	3	220	6.65	247	3	250	12.15
38	<i>geraldina</i>	-	-	-	-	-	-	-	-
39	<i>irma</i>	-	-	-	-	-	-	-	-
40	<i>alepa</i>	128	2	130	3.93	130	3	133	6.47
41	<i>campbelli</i>	-	2	2	0.06	-	1	1	0.05
42	<i>lara</i>	-	-	-	-	-	-	-	-
43	<i>mavroneria</i>	-	-	-	-	-	-	-	-
	Number of specimens	3,277	32	3,309	100.00	2,032	25	2,057	100.00
	Number of species	29	10	30		26	9	27	
	% females	0.967				1.215			
	% species with female	33.333				33.333			

Total Bion dll.				Ameagi				Total all localities/days			
149				28				249			
M	F	M+F	%	M	F	M+F	%	M	F	M+F	%
-	-	-	-	61	-	61	3.52	61	-	61	0.27
21	-	21	0.13	9	-	9	0.52	37	1	38	0.17
865	6	871	5.49	195	-	195	11.24	1,223	6	1,229	5.35
-	-	-	-	-	-	-	-	-	-	-	-
1,842	51	1,893	11.93	181	2	183	10.55	2,227	58	2,285	9.95
29	-	29	0.18	3	-	3	0.17	38	-	38	0.17
1	-	1	0.01	-	-	-	-	64	-	64	0.28
-	-	-	-	-	-	-	-	195	-	195	0.85
1	-	1	0.01	1	-	1	0.06	2	-	2	0.01
833	-	833	5.25	72	-	72	4.15	1,374	1	1,375	5.99
244	5	249	1.57	66	-	66	3.80	336	6	342	1.49
428	1	429	2.70	36	-	36	2.07	696	2	698	3.04
867	-	867	5.46	82	-	82	4.73	1,438	-	1,438	6.26
1,510	-	1,510	9.52	47	-	47	2.71	1,876	-	1,876	8.17
565	-	565	3.56	21	-	21	1.21	724	-	724	3.15
1	-	1	0.01	-	-	-	-	5	-	5	0.02
14	-	14	0.09	4	-	4	0.23	200	-	200	0.87
9	-	9	0.06	-	-	-	-	41	-	41	0.18
137	-	137	0.86	32	-	32	1.84	340	-	340	1.48
188	-	188	1.18	241	-	241	13.89	498	-	498	2.17
-	-	-	-	-	-	-	-	-	-	-	-
931	3	934	5.89	41	-	41	2.36	1,183	7	1,190	5.18
-	-	-	-	-	-	-	-	-	-	-	-
505	-	505	3.18	28	-	28	1.61	919	1	920	4.01
1	-	1	0.01	2	-	2	0.12	3	-	3	0.01
2	-	2	0.01	-	-	-	-	3	-	3	0.01
1,808	5	1,813	11.43	56	-	56	3.23	2,285	5	2,290	9.97
450	-	450	2.84	75	-	75	4.32	714	-	714	3.11
867	20	887	5.59	85	1	86	4.96	1,143	26	1,169	5.09
278	53	331	2.09	96	24	120	6.92	415	81	496	2.16
47	9	56	0.35	7	-	7	0.40	306	24	330	1.44
227	-	227	1.43	24	-	24	1.38	321	2	323	1.41
5	-	5	0.03	4	-	4	0.23	19	-	19	0.08
20	-	20	0.13	22	-	22	1.27	46	-	46	0.20
-	-	-	-	2	-	2	0.12	12	-	12	0.05
21	-	21	0.13	1	-	1	0.06	46	-	46	0.20
4	-	4	0.03	-	-	-	-	4	-	4	0.02
4	-	4	0.03	8	-	8	0.46	12	-	12	0.05
71	5	76	0.48	1	-	1	0.06	80	8	88	0.38
1,718	12	1,730	10.90	96	-	96	5.53	2,278	18	2,296	10.00
-	-	-	-	10	-	10	0.58	10	-	10	0.04
-	-	-	-	-	-	-	-	-	-	-	-
1,121	27	1,148	7.24	84	-	84	4.84	1,463	32	1,495	6.51
5	25	30	0.19	2	12	14	0.81	7	40	47	0.20
-	3	3	0.02	-	-	-	-	-	3	3	0.01
-	-	-	-	1	-	1	0.06	1	-	1	0.00
15,640	225	15,865	100.00	1,696	39	1,735	100.00	22,645	321	22,966	100.00
33	13	34		33	4	33		38	17	39	
1.418				2.248				1.398			
38.235				12.121				43.590			

Table 2. Results on *Delias* (as table 1) recalculated to one day at each site

No	Daerah	Suwagi				Watiangku			
	Pass Valley/Days	56				16			
		M	F	M+F	%	M	F	M+F	%
1	<i>tefominensis</i>	-	-	-	-	-	-	-	-
2	<i>ladas</i>	0.09	-	0.09	0.15	0.13	0.06	0.19	0.15
3	<i>microsticha</i>	1.50	-	1.50	2.54	4.94	-	4.94	3.84
4	<i>rileyi</i>	-	-	-	-	-	-	-	-
5	<i>hypomelas yellow</i>	0.16	-	0.16	0.27	12.19	0.31	12.50	9.72
	<i>hypomelas red</i>	0.05	-	0.05	0.09	0.19	-	0.19	0.15
6	<i>argentata</i>	1.11	-	1.11	1.87	0.06	-	0.06	0.05
	<i>argentata f. sanguinea</i>	3.36	-	3.36	5.68	0.44	-	0.44	0.34
7	<i>destrigata</i>								
8	<i>approximata</i>	5.64	0.02	5.66	9.58	9.56	-	9.56	7.44
9	<i>yabensis</i>	0.02	-	0.02	0.03	1.56	0.06	1.63	1.26
10	<i>subapicalis</i>	3.11	0.02	3.13	5.29	3.63	-	3.63	2.82
11	<i>fascelis</i>	6.34	-	6.34	10.73	8.38	-	8.38	6.51
12	<i>oktanglap</i>	2.23	-	2.23	3.78	12.13	-	12.13	9.43
13	<i>langda</i>	1.25	-	1.25	2.12	4.25	-	4.25	3.31
14	<i>carstenziana</i>	0.07	-	0.07	0.12	-	-	-	-
15	<i>antara</i>	3.20	-	3.20	5.41	0.19	-	0.19	0.15
16	<i>germana</i>	0.52	-	0.52	0.88	0.19	-	0.19	0.15
17	<i>catisa</i>	2.66	-	2.66	4.50	1.38	-	1.38	1.07
18	<i>toxopei</i>	0.36	-	0.36	0.60	3.06	-	3.06	2.38
19	<i>leucobalia</i>	-	-	-	-	-	-	-	-
20	<i>callista</i>	0.48	0.02	0.50	0.85	11.50	0.19	11.69	9.09
21	<i>arabuana</i>								
22	<i>flavistriga</i>	5.68	0.02	5.70	9.64	4.25	-	4.25	3.31
23	<i>awongkor</i>	-	-	-	-	-	-	-	-
24	<i>luctuosa</i>	0.02	-	0.02	0.03	-	-	-	-
25	<i>leucias</i>	4.80	-	4.80	8.13	9.50	-	9.50	7.39
26	<i>rosamontana</i>	2.34	-	2.34	3.96	3.63	-	3.63	2.82
27	<i>hapalina</i>	1.32	0.04	1.36	2.30	7.31	0.19	7.50	5.83
28	<i>nais</i>	0.23	0.04	0.27	0.45	1.75	0.13	1.88	1.46
	<i>nais f. zebra</i>	4.18	0.27	4.45	7.52	1.13	-	1.13	0.88
29	<i>klossi</i>	0.88	0.04	0.91	1.54	1.31	-	1.31	1.02
30	<i>wollastoni</i>	0.13	-	0.13	0.21	0.19	-	0.19	0.15
31	<i>roepkei michiae</i>	0.07	-	0.07	0.12	-	-	-	-
32	<i>autumnalis</i>	0.14	-	0.14	0.24	0.13	-	0.13	0.10
33	<i>walshae</i>	0.43	-	0.43	0.73	-	-	-	-
34	<i>fioretti</i>	-	-	-	-	-	-	-	-
35	<i>isocharis</i>	-	-	-	-	-	-	-	-
36	<i>ligata</i>	-	-	-	-	0.50	0.19	0.69	0.53
37	<i>niepelti</i>	3.88	0.05	3.93	6.65	15.44	0.19	15.63	12.15
38	<i>geraldina</i>	-	-	-	-	-	-	-	-
39	<i>irma</i>	-	-	-	-	-	-	-	-
40	<i>alepa</i>	2.29	0.04	2.32	3.93	8.13	0.19	8.31	6.47
41	<i>campbelli</i>	-	0.04	0.04	0.06	-	0.06	0.06	
42	<i>lara</i>	-	-	-	-	-	-	-	-
43	<i>mavroneria</i>	-	-	-	-	-	-	-	-
	Number of specimens	58.52	0.57	59.09	100.00	127.00	1.56	28.56	100.00
	Number of species	29	10	30		26	9	27	

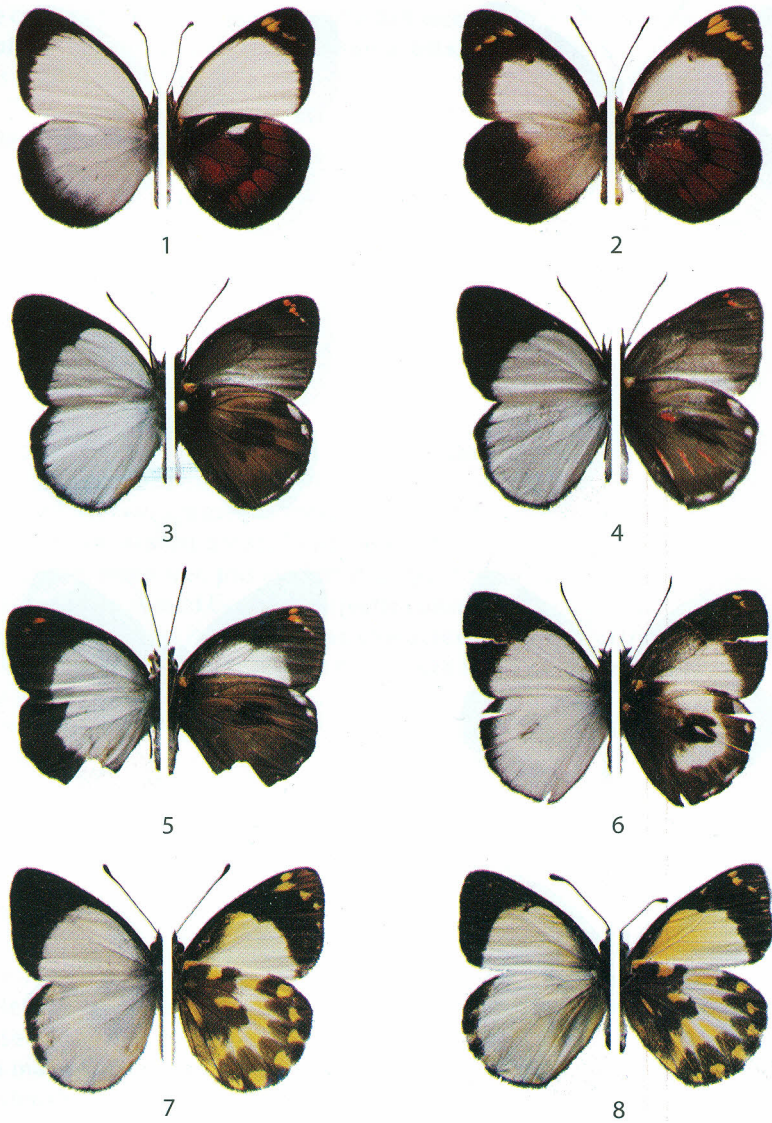
Total Bion dll.				Ameagi				Total all days			
149				28				249			
M	F	M+F	%	M	F	M+F	%	M	F	M+F	%
-	-	-	-	2.18	-	2.18	3.52	0.245	-	0.245	0.266
0.14	-	0.14	0.13	0.32	-	0.32	0.52	0.149	0.004	0.153	0.165
5.81	0.04	5.85	5.49	6.96	-	6.96	11.24	4.912	0.024	4.936	5.351
-	-	-	-	-	-	-	-	-	-	-	-
12.36	0.34	12.70	11.93	6.46	0.07	6.54	10.55	8.944	0.233	9.177	9.949
0.19	-	0.19	0.18	0.11	-	0.11	0.17	0.153	-	0.153	0.165
0.01	-	0.01	0.01	-	-	-	-	0.257	-	0.257	0.279
-	-	-	-	-	-	-	-	0.783	-	0.783	0.849
0.01	-	0.01	0.01	0.04	-	0.04	0.06	0.008	-	0.008	0.009
5.59	-	5.59	5.25	2.57	-	2.57	4.15	5.518	0.004	5.522	5.987
1.64	0.03	1.67	1.57	2.36	-	2.36	3.80	1.349	0.024	1.373	1.489
2.87	0.01	2.88	2.70	1.29	-	1.29	2.07	2.795	0.008	2.803	3.039
5.82	-	5.82	5.46	2.93	-	2.93	4.73	5.775	-	5.775	6.261
10.13	-	10.13	9.52	1.68	-	1.68	2.71	7.534	-	7.534	8.169
3.79	-	3.79	3.56	0.75	-	0.75	1.21	2.908	-	2.908	3.152
0.01	-	0.01	0.01	-	-	-	-	0.020	-	0.020	0.022
0.09	-	0.09	0.09	0.14	-	0.14	0.23	0.803	-	0.803	0.871
0.06	-	0.06	0.06	-	-	-	-	0.165	-	0.165	0.179
0.92	-	0.92	0.86	1.14	-	1.14	1.84	1.365	-	1.365	1.480
1.26	-	1.26	1.18	8.61	-	8.61	13.89	2.000	-	2.000	2.168
-	-	-	-	-	-	-	-	-	-	-	-
6.25	0.02	6.27	5.89	1.46	-	1.46	2.36	4.751	0.028	4.779	5.182
-	-	-	-	-	-	-	-	-	-	-	-
3.39	-	3.39	3.18	1.00	-	1.00	1.61	3.691	0.004	3.695	4.006
0.01	-	0.01	0.01	0.07	-	0.07	0.12	0.012	-	0.012	0.013
0.01	-	0.01	0.01	-	-	-	-	0.012	-	0.012	0.013
12.13	0.03	12.17	11.43	2.00	-	2.00	3.23	9.177	0.020	9.197	9.971
3.02	-	3.02	2.84	2.68	-	2.68	4.32	2.867	-	2.867	3.109
5.82	0.13	5.95	5.59	3.04	0.04	3.07	4.96	4.590	0.104	4.695	5.090
1.87	0.36	2.22	2.09	3.43	0.86	4.29	6.92	1.667	0.325	1.992	2.160
0.32	0.06	0.38	0.35	0.25	-	0.25	0.40	1.229	0.096	1.325	1.437
1.52	-	1.52	1.43	0.86	-	0.86	1.38	1.289	0.008	1.297	1.406
0.03	-	0.03	0.03	0.14	-	0.14	0.23	0.076	-	0.076	0.083
0.13	-	0.13	0.13	0.79	-	0.79	1.27	0.185	-	0.185	0.200
-	-	-	-	0.07	-	0.07	0.12	0.048	-	0.048	0.052
0.14	-	0.14	0.13	0.04	-	0.04	0.06	0.185	-	0.185	0.200
0.03	-	0.03	0.03	-	-	-	-	0.016	-	0.016	0.017
0.03	-	0.03	0.03	0.29	-	0.29	0.46	0.048	-	0.048	0.052
0.48	0.03	0.51	0.48	0.04	-	0.04	0.06	0.321	0.032	0.353	0.383
11.53	0.08	11.61	10.90	3.43	-	3.43	5.53	9.149	0.072	9.221	9.997
-	-	-	-	0.36	-	0.36	0.58	0.040	-	0.040	0.044
-	-	-	-	-	-	-	-	-	-	-	-
7.52	0.18	7.70	7.24	3.00	-	3.00	4.84	5.876	0.129	6.004	6.510
0.03	0.17	0.20	0.19	0.07	0.43	0.50	0.81	0.028	0.161	0.189	0.205
-	0.02	0.02	0.02	-	-	-	-	-	0.012	0.012	0.013
-	-	-	-	0.04	-	0.04	0.06	0.004	-	0.004	0.004
104.97	1.51	106.48	100.00	60.57	1.39	61.96	100.00	90.944	1.289	92.233	100.00
34	13	35		33	4	33		38	17	39	



Map of route from Baliem Valley to Pass Valley,
with collecting spots of Henk van Mastrigt c.s.:

1. River Suwagi; 2. River Watlangku; 3. Bion area; 4. River Ameagi.

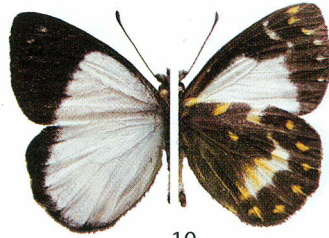
(Map prepared by Peter Loud – downloaded from internet,
adjusted and corrected by author)



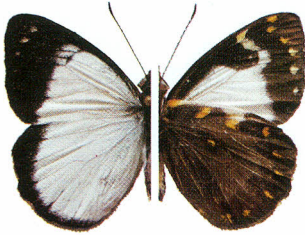
Figs 1-8. *Delias* sp. upp./und.: 1. *D. telefominensis* ♂ (KSP 22613); 2. idem ♀ (KSP 22662) from Abmisibil, Star Mts; 3. *D. hypomelas* ♂ (KSP 26041); 4. idem (KSP 26034); 5. idem ♀ (KSP 26042); 6. *D. destrigata* PT ♂ (KSP 26343); 7. *D. subapicalis* ♂ PT (KSP 4156); 8. idem PT ♀ (KSP 56725).



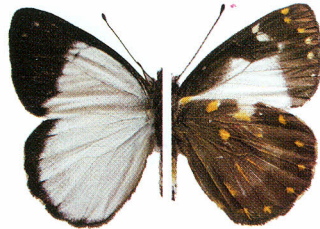
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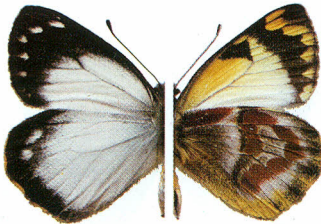
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11



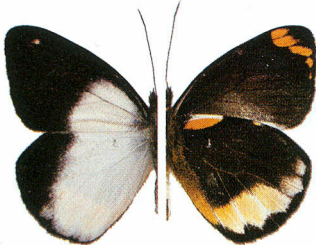
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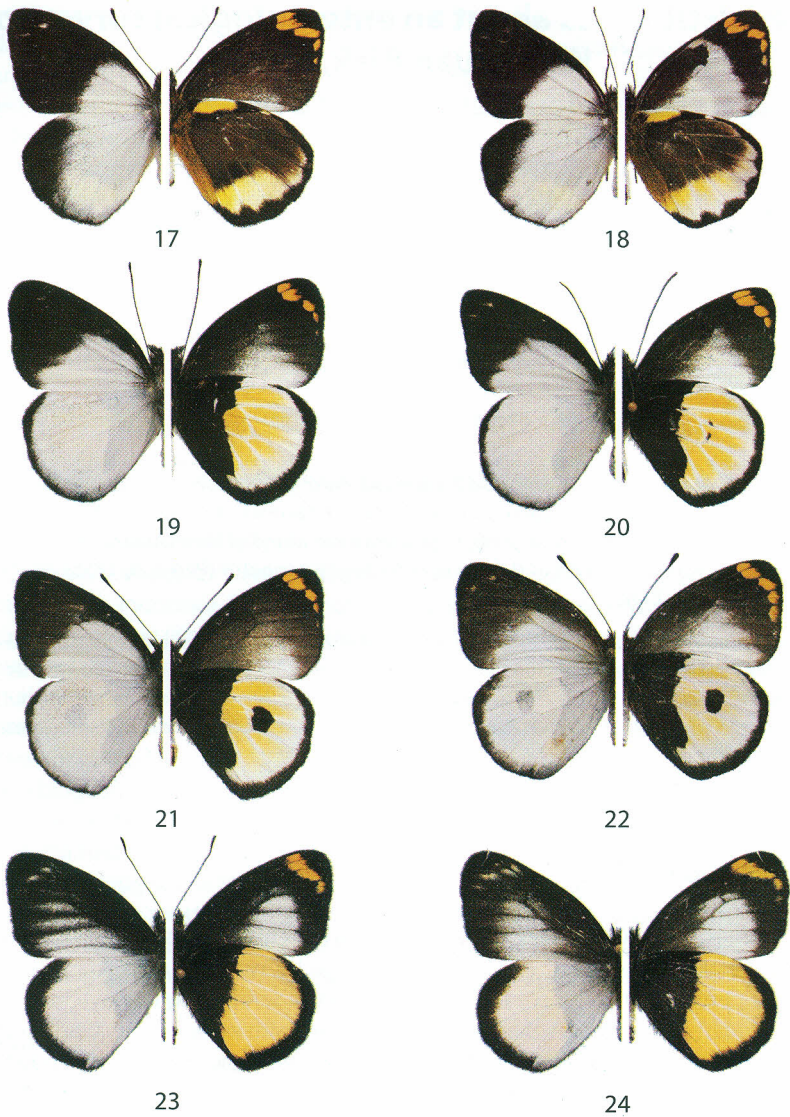


15



16

Figs 9-16. *Delias* sp. upp./und.: 9. *D. oktanglap nishiyamai* ♂ (KSP 5243); 10. idem ♂ (KSP 5241); 11. *D. langda waktangku* PT ♂ (KSP 5390); 12. idem PT ♂ (KSP 5393); 13. *D. wollastoni abmisibilensis* ♂ (KSP 21230); 14. *D. roepkei cieko* ♂ form A (KSP 22156); 15. idem ♂ form B (KSP 22161); 16. idem ♂ form C (KSP 22164).



Figs 17-24. *Delias* sp. upp./und.: 17. *D. roepkei cieko* ♀ form D (KSP 22182); 18. *D. autumnalis michiae* ♂ (KSP 22528); 19. *D. walshae sanaea* ♂ (KSP 22065); 20. idem ♂ (KSP 22063); 21. idem ♂ (KSP 22029); 22. idem ♀ (KSP 22049); 23. *D. fioretti* ♂ (KSP 22108); 24. idem ♀ (KSP 22110).