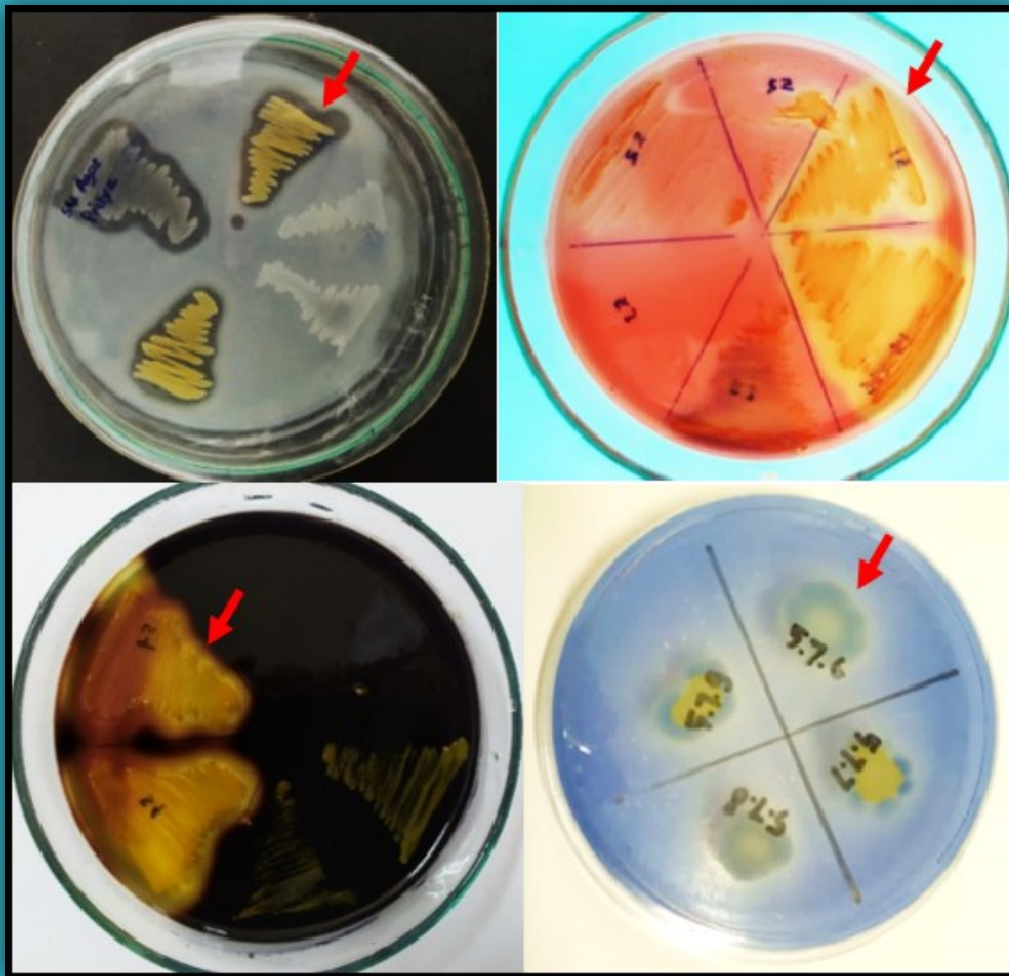


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# THE DIVERSITY OF BUTTERFLY IN AIR DINGIN LANDFILLS, BALAI GADANG, PADANG CITY

[Diversitas Kupu-Kupu di Tempat Pembuangan Akhir (TPA) Air Dingin, Balai Gadang, Kota Padang]

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## ABSTRACT

The study of butterfly in the in Air Dingin Landfills needs to be carried out to find out what types of butterflies are in this area and how their diversity is, given the increasing area of Landfills that will change the surrounding environment into a place of rubbish heap. The study was conducted by implementing survey method with insect net. The collection of butterflies was carried out in 2 periods (2x6 = 12 days) in April -June 2019 during sunny weather from 09:00 – 12:00 of Western Indonesian Time. All butterflies were collected at  $\pm 5$  m distance from the collector. The data was analysed to calculate abundance, relative abundance, frequency of the presence of butterfly, and determine diversity was conducted by using the Shannon-Wiener Index and Evenness index. The results obtained 5 families, 14 genera, 22 species, and 220 individuals consisting of 122 males and 98 females. The diversity index value obtained was 2.27 and categorised as the medium category it is mostly because, as assumed, the environmental conditions of the Air Dingin Landfills were still in good condition.

**Keywords:** Butterfly, Lepidoptera, TPA Air Dingin

## ABSTRAK

Penelitian kupu-kupu pada kawasan Tempat Pembuangan Akhir (TPA) Air Dingin perlu dilakukan untuk mengetahui jenis kupu-kupu apa saja yang ada di kawasan ini dan bagaimana diversitasnya mengingat semakin luasnya area TPA yang akan merubah lingkungan disekitarnya menjadi tempat timbunan sampah. Penelitian dilakukan menggunakan metode survey dengan jaring serangga (*insect net*). Pengoleksian kupu-kupu dilakukan 2 periode (2x6 = 12 hari) pada bulan April-Juni 2019 pada saat cuaca cerah dari pukul 09.00 – 12.00 WIB. Semua kupu-kupu dikoleksi dengan jarak  $\pm 5$  m dari kolektor. Analisis data untuk menghitung kelimpahan, kelimpahan relatif, frekuensi kehadiran kupu-kupu, dan menentukan diversitas digunakan Indeks Shannon-Wiener dan indeks Evenness. Hasil penelitian didapatkan 5 famili, 14 genera, 22 spesies dan 220 individu yang terdiri dari 122 jantan dan 98 betina. Nilai indeks diversitas yang diperoleh adalah 2,27 yang tergolong kedalam kategori sedang hal ini dikarenakan kondisi lingkungan TPA Air Dingin masih dalam kondisi baik.

**Kata kunci:** Kupu-kupu, Lepidoptera, TPA Air Dingin

## INTRODUCTION

Butterflies are very sensitive to habitat destruction and environmental changes that can be seen from the changes in their community composition and have been used generally as a taxonomy indicator for ecological research (Kremen, 1994; Koh and Sodhi, 2004; Brown, 1997).

They also have different ecological needs depending on the level of their life cycle. Adult butterflies eat nectar, fruits, dung, and animal carcasses to obtain energy and look for certain host plants to lay eggs. Some larvae are oligolectic and some only eat certain plants, so that the presence of host plants can indicate the environmental conditions (Kremen, 1994; Brown, 1997).

Currently, Indonesia has quite a number of butterfly species, estimated to be around 2.500 species. In Sumatra, there are estimated to be around 1000 species of butterflies, but there is no complete data on the diversity of these butterflies (Soekardi, 2007). Based on a study conducted by Dahelmi,

Salmah, and Primadalvi (2010), it is reported that there are about 325 species of butterflies in West Sumatra.

Researches on butterflies have been conducted in some spots in West Sumatra. Luk *et al.* (2011) in Siberut Mentawai found 244 individuals from 20 species of butterflies in the island. Sitompul (2008) in Rimbo Pasaman forest found 245 individuals from 37 species in an area under a canopy layer of the forest, while in a gap area it was found 152 individuals out of 28 species. Salmah and Abbas (2006) who conducted a research in the Forest Education and Biological Research (HPPB) of Andalas University in Padang, found 36 species of butterflies. Whereas in Aie Sirah forest the number of butterflies found was less than that in the HPPB, namely 22 species only. With regard to this research, it was conducted in an area where city garbage was finally dumped or also called Landfills, namely of Air Dingin Landfills. This spot was chosen because there has been no research on butterflies in that area

\*Kontributor Utama

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before. Air Dingin Landfills is a hilly plain area located more or less 17 km from the city center of Padang, it covers an area of 18.5 hectares and serves as a place for final garbage disposal receiving 400–450 tons of garbage every day. It is assumed that the waste generation in this area will be larger and larger given the growing population of Padang City. Research on the diversity and types of butterflies in Air Dingin Landfills has never been done before. In addition, there has been no clear information available about the diversity and types of butterflies in Air Dingin Landfills. It is important and interesting to know what types of butterflies in the Landfills area since it is assumed that the existence of the Landfills may have an impact to the butterflies, mostly in the form of decreasing the butterfly diversity in the future. Moreover, the spreading of the Landfills to a larger area shall change the surrounding environment into mountainous pile of garbage in such a way that the butterflies shall face the threat of extinction resulting from the change in the land-use of their habitat.

## MATERIALS AND METHODS

**Study Area.** Air Dingin Landfill is located in Air Dingin village, Koto Tengah sub-district, Padang City with a distance of approximately 17 km from the city centre, which has an area of 30.30 hectares. It is a hilly area with a clay soil type with a depth of 8 metres (Yatim and Mukhlis, 2013). The area in the

north and east of Air Dingin Landfills are hilly areas, while the south and west are the lowlands which are crossed by the Batang Air Dingin river and bordered by settlements. The site position is at coordinates 0°49'30 "N 100°22'57" E, with an average slope between 10°–35°.

**Sampling Procedures.** The study was conducted in two months (April 2019 and June 2019) in Air Dingin Landfills by using survey method with insect net. The collection of butterfly samples was carried out during sunny weather from 09:00 – 12:00 of Western Indonesian Time. All butterflies were collected at  $\pm 5$  m distance from the collector.

**Statistical Analyses.** The diversity of butterfly was calculated by using the Shanon-Wiener Index (Fermont, 2002) and the specific evenness in a habitat was calculated by using the species evenness index formula (Magurran, 2004).

## RESULTS

The butterflies found at Air Dingin Landfills through the insect net method overall were 22 species, 14 genera, 5 families and 220 individuals (Table 1). The butterfly species found can be seen in Figure 2. The range of temperature and humidity at the sample collection location were between 35°C – 41°C and 51% – 66%. Temperature and light would greatly influence the butterflies' activity, spread,



**Figure 1.** The Location of the Collection of Butterfly Samples at Air Dingin Landfills (*Lokasi Pengoleksian Sampel Kupu-Kupu (Rhopalocera) di Tempat Pembuangan Akhir (TPA) Air Dingin*) Source: Wikimapia.org,10/03/2020

growth and breeding. Sunjaya (1970) states that light is needed by the butterflies because they are cold-blooded (poikilothermic). Light will provide heat energy, so it can escalate the body temperature and accelerate metabolism. In butterfly larvae, the increase of body temperature will accelerate their development. According to Akutsu *et al.* (2007), temperature will affect the activity, spread, growth and reproduction of insects. Generally, butterflies are more active at high temperature since that is when the metabolism in their body increases, and vice versa.

The families with the most number of species out of the total number of butterflies found at Landfills in Air Dingin were Nymphalidae and Papilionidae in which both of them consisted of 7 species. The Nymphalidae family found therein

consisted of 48 individuals with Junonia as dominant genera (2 species and 12 individuals). The Papilionidae family consists of 27 individuals with Papilio as the dominant genera (5 species and 20 individuals) and then followed by the Pieridae family with a total of 6 butterfly species and 142 individuals with the dominant genera were Catopsilia (3 species and 17 individuals). While the lowest numbers of butterflies were found in the Hesperidae family with only 1 species (*Udaspes folus*) and the Lycaenidae family with also 1 species (*Jamides zebra*). *Appias olferna* was the species with the highest number of individuals found, consisting of 71 individuals belonging to the family Pieridae. This is presumably because the surrounding environment of Air Dingin Landfill is in the form open area and the butterflies usually fly in groups and in large numbers. Miller

**Table 1.** Species list and total number of individuals of butterflies that found in Air Dingin Landfills (*Daftar Spesies dan Jumlah Total Individu Kupu-Kupu yang Ditemukan di Tempat Pembuangan Akhir (TPA) Air Dingin*)

No	Family (Species)	Collection Method Insect Net Number of Individuals
<b>I</b>	<b>Hesperidae</b>	
1	<i>Udaspes folus</i>	1
<b>II</b>	<b>Lycaenidae</b>	
2	<i>Jamides zebra</i>	2
<b>III</b>	<b>Nymphalidae</b>	
3	<i>Acraea terpsicore</i>	15
4	<i>Doleschallia bisaltide</i>	1
5	<i>Hypolimnas bolina</i>	5
6	<i>Junonia atlites</i>	11
7	<i>Junonia orithya</i>	1
8	<i>Neptis hylas</i>	13
9	<i>Phaedyra columella</i>	2
<b>IV</b>	<b>Papilionidae</b>	
10	<i>Graphium agamemnon</i>	4
11	<i>Graphium sarpedon</i>	3
12	<i>Papilio demoleus</i>	7
13	<i>Papilio memnon</i>	1
14	<i>Papilio nephelus</i>	1
15	<i>Papilio palinurus</i>	1
16	<i>Papilio polytes</i>	10
<b>V</b>	<b>Pieridae</b>	
17	<i>Appias olferna</i>	71
18	<i>Catopsilia pyranthe</i>	5
19	<i>Catopsilia pomona</i>	1
20	<i>Catopsilia scylla</i>	11
21	<i>Eurema hecabe</i>	49
22	<i>Leptosia nina</i>	5
Total number of individuals		220
Total Number of species		22
Diversity Index (H')		2,271
Evenness Index (E)		0,735



and Miller (2004) state that almost all species of the Pieridae family preferred open habitats and adequate sunlight.

## DISCUSSION

The difference in the number of butterfly species found at the collection site is influenced by the diversity of plants as host plants and the collection methods that are used. Simanjuntak (2000) states that the difference in the number of butterflies found is influenced by the season, weather, time of catching the butterflies, and the number of collectors at the time of collecting. In addition, Patton (1963) states that various types of butterflies are different in choosing the type of host plants that feed on their larvae. Further, Krebs (1978) suggests that the difference in the number of butterfly species is also influenced by temperature, humidity, rainfall, light, predators and parasites. Moreover, in the location of collection, it was also found various types of plants in the form of bushes and shrubs which were used as shelter and flowering plants as a food source for the butterflies. This is in accordance with the opinion of Koh and Sodhi (2004) that vegetation is a source of food and shelter for the butterfly species and the difference in the number of butterfly species in a habitat is also influenced by tree canopy cover and sunlight intensity.

The diversity index ( $H'$ ) of butterflies generally found at Air Dingin Landfills is 2.27 which is classified into the medium category (Table 1). Krebs (1978) argues that the diversity index value can be used to determine the nature of different communities. If the diversity index is high, it means that the type and number of individuals in the community are different (heterogeneous) and vice versa. The diversity index value is determined by the number of individuals found in a community.

In general butterfly diversity index as found in the area is categorized as moderate, it is mostly because, as assumed, the environmental conditions of the Air Dingin Landfills were still in good condition. In line with Muhelni, Herwina and Dahelmi (2016), butterflies found in 25 species with the same diversity index 2.72 belong to the category of being stated the same thing that this is thought to be because forest conditions are still in good

condition. De Vries, Debra and Russell (1997) confirmed that, an area with good habitat contains highest species which are rich of the most unique species. In addition, the aspect that influences the current level of diversity index of butterflies in Air Dingin Landfill is the existence of plant species that are bearing fruit and flowering around the environment of Air Dingin Landfill, and they are used by butterflies for food and as host plants (Table 2). Whitten, Soeriaatmadja and Affiff (1999) stated that, the survival of butterflies is greatly supported by the availability of plants as their source of food, as a medium for laying eggs and as a protector both on the larval stage and on the imago stage (adult butterfly). Soekardi (2007) states that, butterflies also need plants that are suitable for feeding their larvae (host plants).

The environmental condition at Air Dingin Landfills which directly borders Bukit Barisan is also highly open, so that the sunlight is not blocked by tree canopy cover because it also affects the presence of butterflies. Peggie and Amir (2006) state that butterflies are generally found on sunny days and in open places. In open areas, they will be more easily found because the sun will directly illuminate the plants, so that the plants will more quickly carry out the process of photosynthesis. When the plants carry out the photosynthesis process, butterflies will land on the plants to suck the flowers' nectar. The presence and activity of butterflies varies greatly with the structure of vegetation and the open canopy in the spot that provides enough space and light. Environmental conditions like these have a positive effect on many types of butterflies flying around in the area, and consequently affect the richness of the species (Vogel *et al.*, 2007; Saika *et al.*, 2009; Koneril and Suroyo 2012).

Thomas *et al.* (2004) argue that the more butterflies in a habitat, the better the environment. This is in line with the opinion of Kremen (1992) which states that butterflies have been considered as an effective group for assessing habitat damage. Butterflies are also very sensitive to environmental changes that can be seen from the changes in the composition of their communities. Therefore, butterflies are very well used as an indicator of



**Figure 2.** Hesperidae (A), Lycaenidae (B), Nymphalidae (C-I) Papilionidae (J-P) and Pieridae (Q-V) butterflies that were found at Air Dingin Landfills (A. *Udaspes folus*, B. *Jamides zebra*, C. *Acraea terpsicore*, D. *Doleschallia bisaltide*, E. *Hypolimnas bolina*, F. *Junonia atlites*, G. *Junonia orithya*, H. *Neptis hylas*, I. *Phaedyra columella*, J. *Graphium agamemnon*, K. *Graphium sarpedon*, L. *Papilio demoleus*, M. *Papilio memnon*, N. *Papilio nepheus*, O. *Papilio polytes*, P. *Papilio palinurus*, Q. *Appias olferna*, R. *Catopsilia phyanthe*, S. *Leptosia nina*, T. *Catopsilia scylla*, U. *Eurema hecabe*, V. *Catopsilia pomona*)

**Table 2.** Types of Flowering Plants Collected at the Location of Butterfly Sample Collection at Air Dingin Landfills (*Jenis Tanaman berbunga yang dikoleksi pada lokasi Pengambilan sampel Kupu-Kupu (Rhopalocera) di TPA Air Dingin*)

No	Family	Species
1a	Compositae	<i>Mikania micrantha</i> Kunth.
1b	Passifloreceae	<i>Passiflora foetida</i> L.
2	Compositae	<i>Ageratum conyzoides</i> (L.) L.
3	Malvaceae	<i>Urena lobata</i> L.
4	Euphorbiaceae	<i>Jatropha gossypifolia</i> L.
5	Verbenaceae	<i>Lantana camara</i> L.
6	Malvaceae	<i>Sida cordifolia</i> L.
7	Compositae	<i>Xanthium strumarium</i> L.
8	Leguminosae	<i>Sena tora</i> (L.) Roxb.
9	Rutaceae	<i>Clausena excavata</i> Burm.f.
10	Euphorbiaceae	<i>Ricinus communis</i> L.
11	Vitaceae	<i>Cissus repens</i> Lam.
12	Leguminosae	<i>Crotalaria pallida</i> Aiton

forest and environmental quality (Brown, 1997). Koh and Sodhi (2004) also state that the number of butterflies in general really depends on the management of an area. Protected areas have a higher butterfly species diversity compared to those that have experienced land conversion.

Therefore, the presence of butterfly species in Air Dingin Landfills area ought to be used by the landfill management as reference in carrying out future operation and development of the area, so as to maintain the preservation of butterfly species found in the area. By this research, it is hoped that the Air Dingin Landfills area may become a butterfly information center and serve as butterfly education and research forum in West Sumatra Province henceforward.

The overall evenness index (E) obtained at Air Dingin Landfills is 0.72 with the category of fairly evenly distributed. The index found in the location of Air Dingin Landfills is estimated to be due to the existence of vegetation types that are not spread evenly at the collection site, the absence of clean water flow, and the air condition with strong odours. Such environmental conditions are highly unsupportive for the survival of butterflies.

The higher the value of species evenness indicates that the number of individuals of each species is getting more uniform (Winarni, 2005). The evenness index value is a measure of balance between one community and another. This value is influenced by the number of species found in one community. The higher the value of species

diversity in a habitat, the higher the balance of the community (Ludwig and Reynolds, 1988). The species evenness shows the composition of the number of individuals per species in a particular habitat. The more evenly an animal distributed in a particular location, the better the environmental conditions. Hence, they can support the survival of the species (Fachrul, 2012).

## CONCLUSION

The butterflies were found at Air Dingin Landfills as many as 5 families, 14 genera, 22 species, and 220 individuals consisting of 122 males and 98 females with the diversity index ( $H'$ ) of 2.27 which was categorised as the medium category.

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# Pedoman Penulisan Naskah Berita Biologi

**Berita Biologi** adalah jurnal yang menerbitkan artikel kemajuan penelitian di bidang biologi dan ilmu-ilmu terkait di Indonesia. Berita Biologi memuat karya tulis ilmiah asli berupa makalah hasil penelitian, komunikasi pendek dan tinjauan kembali yang belum pernah diterbitkan atau tidak sedang dikirim ke media lain. Masalah yang diliput harus menampilkan aspek atau informasi baru.

## Tipe naskah

### 1. Makalah lengkap hasil penelitian (*original paper*)

Naskah merupakan hasil penelitian sendiri yang mengangkat topik yang *up to date*. Tidak lebih dari 15 halaman termasuk tabel dan gambar. Pencantuman lampiran seperlunya, namun redaksi berhak mengurangi atau meniadakan lampiran.

### 2. Komunikasi pendek (*short communication*)

Komunikasi pendek merupakan makalah hasil penelitian yang ingin dipublikasikan secara cepat karena hasil temuan yang menarik, spesifik dan atau baru, agar dapat segera diketahui oleh umum. Hasil dan pembahasan dapat digabung.

### 3. Tinjauan kembali (*review*)

Tinjauan kembali merupakan rangkuman tinjauan ilmiah yang sistematis-kritis secara ringkas namun mendalam terhadap topik penelitian tertentu. Hal yang ditinjau meliputi segala sesuatu yang relevan terhadap topik tinjauan yang memberikan gambaran *'state of the art'*, meliputi temuan awal, kemajuan hingga issue terkini, termasuk perdebatan dan kesenjangan yang ada dalam topik yang dibahas. Tinjauan ulang ini harus merangkum minimal 30 artikel.

## Struktur naskah

### 1. Bahasa

Bahasa yang digunakan adalah Bahasa Indonesia atau Inggris yang baik dan benar.

### 2. Judul

Judul diberikan dalam bahasa Indonesia dan Inggris. Judul ditulis dalam huruf tegak kecuali untuk nama ilmiah yang menggunakan bahasa latin. Judul harus singkat, jelas dan mencerminkan isi naskah dengan diikuti oleh nama serta alamat surat menyurat penulis dan alamat email. Nama penulis untuk korespondensi diberi tanda amplop cetak atas (*superscript*). Jika penulis lebih dari satu orang bagi pejabat fungsional penelitian, pengembangan agar menentukan status sebagai kontributor utama melalui penandaan simbol dan keterangan sebagai kontributor utama dicatatkan kaki di halaman pertama artikel.

### 3. Abstrak

Abstrak dibuat dalam dua bahasa, bahasa Indonesia dan Inggris. Abstrak memuat secara singkat tentang latar belakang, tujuan, metode, hasil yang signifikan, kesimpulan dan implikasi hasil penelitian. Abstrak berisi maksimum 200 kata, spasi tunggal. Di bawah abstrak dicantumkan kata kunci yang terdiri atas maksimum enam kata, dimana kata pertama adalah yang terpenting. Abstrak dalam Bahasa Inggris merupakan terjemahan dari Bahasa Indonesia. Editor berhak untuk mengedit abstrak demi alasan kejelasan isi abstrak.

### 4. Pendahuluan

Pendahuluan berisi latar belakang, permasalahan dan tujuan penelitian. Perlu disebutkan juga studi terdahulu yang pernah dilakukan terkait dengan penelitian yang dilakukan.

### 5. Bahan dan cara kerja

Bahan dan cara kerja berisi informasi mengenai metode yang digunakan dalam penelitian. Pada bagian ini boleh dibuat sub-judul yang sesuai dengan tahapan penelitian. Metoda harus dipaparkan dengan jelas sesuai dengan standar topik penelitian dan dapat diulang oleh peneliti lain. Apabila metoda yang digunakan adalah metoda yang sudah baku cukup ditulis sitasinya dan apabila ada modifikasi maka harus dituliskan dengan jelas bagian mana dan hal apa yang dimodifikasi.

### 6. Hasil

Hasil memuat data ataupun informasi utama yang diperoleh berdasarkan metoda yang digunakan. Apabila ingin mengacu pada suatu tabel/grafik/diagram atau gambar, maka hasil yang terdapat pada bagian tersebut dapat diuraikan dengan jelas dengan tidak menggunakan kalimat 'Lihat Tabel 1'. Apabila menggunakan nilai rata-rata maka harus menyertakan pula standar deviasinya.

### 7. Pembahasan

Pembahasan bukan merupakan pengulangan dari hasil. Pembahasan mengungkap alasan didapatkannya hasil dan arti atau makna dari hasil yang didapat tersebut. Bila memungkinkan, hasil penelitian ini dapat dibandingkan dengan studi terdahulu.

### 8. Kesimpulan

Kesimpulan berisi informasi yang menyimpulkan hasil penelitian, sesuai dengan tujuan penelitian, implikasi dari hasil penelitian dan penelitian berikutnya yang bisa dilakukan.

### 9. Ucapan terima kasih

Bagian ini berisi ucapan terima kasih kepada suatu instansi jika penelitian ini didanai atau didukung oleh instansi tersebut, ataupun kepada pihak yang membantu langsung penelitian atau penulisan artikel ini.

### 10. Daftar pustaka

Tidak diperkenankan untuk mensitasi artikel yang tidak melalui proses *peer review*. Apabila harus menyitir dari "laporan" atau "komunikasi personal" dituliskan '*unpublished*' dan tidak perlu ditampilkan di daftar pustaka. Daftar pustaka harus berisi informasi yang *up to date* yang sebagian besar berasal dari *original papers* dan penulisan terbitan berkala ilmiah (nama jurnal) tidak disingkat.

## Format naskah

- Naskah diketik dengan menggunakan program Microsoft Word, huruf New Times Roman ukuran 12, spasi ganda kecuali Abstrak spasi tunggal. Batas kiri-kanan atas-bawah masing-masing 2,5 cm. Maksimum isi naskah 15 halaman termasuk ilustrasi dan tabel.
- Penulisan bilangan pecahan dengan koma mengikuti bahasa yang ditulis menggunakan dua angka desimal di belakang koma. Apabila menggunakan Bahasa Indonesia, angka desimal ditulis dengan menggunakan koma (,) dan ditulis dengan menggunakan titik (.) bila menggunakan bahasa Inggris. Contoh: Panjang buku adalah 2,5 cm. Length of the book is 2.5 cm. Penulisan angka 1-9 ditulis dalam kata kecuali bila bilangan satuan ukur, sedangkan angka 10 dan seterusnya ditulis dengan angka. Contoh lima orang siswa, panjang buku 5 cm.
- Penulisan satuan mengikuti aturan *international system of units*.
- Nama takson dan kategori taksonomi ditulis dengan merujuk kepada aturan standar yang diakui. Untuk tumbuhan menggunakan *International Code of Botanical Nomenclature* (ICBN), untuk hewan menggunakan *International Code of Zoological Nomenclature* (ICZN), untuk jamur *International Code of Nomenclature for Algae, Fungi and Plant* (ICFAFP), *International Code of Nomenclature of Bacteria* (ICNB), dan untuk organisme yang lain merujuk pada kesepakatan Internasional. Penulisan nama takson lengkap dengan nama author hanya dilakukan pada bagian deskripsi takson, misalnya pada naskah taksonomi. Penulisan nama takson untuk bidang lainnya tidak perlu menggunakan nama author.
- Tata nama di bidang genetika dan kimia merujuk kepada aturan baku terbaru yang berlaku.
- Untuk range angka menggunakan en dash (–), contohnya pp.1565–1569, jumlah anak-anak berkisar 7–8 ekor. Untuk penggabungan kata menggunakan hyphen (-), contohnya: masing-masing.
- Ilustrasi dapat berupa foto (hitam putih atau berwarna) atau gambar tangan (*line drawing*).
- Tabel  
Tabel diberi judul yang singkat dan jelas, spasi tunggal dalam bahasa Indonesia dan Inggris, sehingga Tabel dapat berdiri sendiri. Tabel diberi nomor urut sesuai dengan keterangan dalam teks. Keterangan Tabel diletakkan di bawah Tabel. Tabel tidak dibuat tertutup dengan garis vertikal, hanya menggunakan garis horisontal yang memisahkan judul dan batas bawah.

8. Gambar  
Gambar bisa berupa foto, grafik, diagram dan peta. Judul gambar ditulis secara singkat dan jelas, spasi tunggal. Keterangan yang menyertai gambar harus dapat berdiri sendiri, ditulis dalam bahasa Indonesia dan Inggris. Gambar dikirim dalam bentuk .jpeg dengan resolusi minimal 300 dpi, untuk *line drawing* minimal 600dpi.
9. Daftar Pustaka  
Sitasi dalam naskah adalah nama penulis dan tahun. Bila penulis lebih dari satu menggunakan kata 'dan' atau *et al.* Contoh: (Kramer, 1983), (Hamzah dan Yusuf, 1995), (Premachandra *et al.*, 1992). Bila naskah ditulis dalam bahasa Inggris yang menggunakan citasi 2 orang penulis maka digunakan kata 'and'. Contoh: (Hamzah and Yusuf, 1995). Jika sitasi beruntun maka dimulai dari tahun yang paling tua, jika tahun sama maka dari nama penulis sesuai urutan abjad. Contoh: (Anderson, 2000; Agusta *et al.*, 2005; Danar, 2005). Penulisan daftar pustaka, sebagai berikut:
  - a. **Jurnal**  
Nama jurnal ditulis lengkap.  
Agusta, A., Maehara, S., Ohashi, K., Simanjuntak, P. and Shibuya, H., 2005. Stereoselective oxidation at C-4 of flavans by the endophytic fungus *Diaporthe* sp. isolated from a tea plant. *Chemical and Pharmaceutical Bulletin*, 53(12), pp.1565–1569.
  - b. **Buku**  
Anderson, R.C. 2000. *Nematode Parasites of Vertebrates, Their Development and Transmission*. 2nd ed. CABI Publishing, New York. pp. 650.
  - c. **Prosiding atau hasil Simposium/Seminar/Lokakarya.**  
Kurata, H., El-Samad, H., Yi, T.M., Khammash, M. and Doyle, J., 2001. Feedback Regulation of the Heat Shock Response in *Eschericia coli*. *Proceedings of the 40th IEEE Conference on Decision and Control*. Orlando, USA. pp. 837–842.
  - d. **Makalah sebagai bagian dari buku**  
Sausan, D., 2014. Keanekaragaman Jamur di Hutan Kabungolor, Tau Lumbis Kabupaten Nunukan, Kalimantan Utara. Dalam: Irham, M. & Dewi, K. eds. *Keanekaragaman Hayati di Beranda Negeri*. pp. 47–58. PT. Eaststar Adhi Citra. Jakarta.
  - e. **Thesis, skripsi dan disertasi**  
Sundari, S., 2012. Soil Respiration and Dissolved Organic Carbon Efflux in Tropical Peatlands. *Dissertation*. Graduate School of Agriculture. Hokkaido University. Sapporo. Japan.
  - f. **Artikel online.**  
Artikel yang diunduh secara online ditulis dengan mengikuti format yang berlaku untuk jurnal, buku ataupun thesis dengan dilengkapi alamat situs dan waktu mengunduh. Tidak diperkenankan untuk mensitasi artikel yang tidak melalui proses peer review misalnya laporan perjalanan maupun artikel dari laman web yang tidak bisa dipertanggung jawabkan kebenarannya seperti wikipedia.  
Himman, L.M., 2002. A Moral Change: Business Ethics After Enron. San Diego University Publication. <http://ethics.sandiego.edu/LMH/oped/Enron/index.asp>. (accessed 27 Januari 2008) bila naskah ditulis dalam bahasa inggris atau (diakses 27 Januari 2008) bila naskah ditulis dalam bahasa indonesia

#### **Formulir persetujuan hak alih terbit dan keaslian naskah**

Setiap penulis yang mengajukan naskahnya ke redaksi Berita Biologi akan diminta untuk menandatangani lembar persetujuan yang berisi hak alih terbit naskah termasuk hak untuk memperbanyak artikel dalam berbagai bentuk kepada penerbit Berita Biologi. Sedangkan penulis tetap berhak untuk menyebarkan edisi cetak dan elektronik untuk kepentingan penelitian dan pendidikan. Formulir itu juga berisi pernyataan keaslian naskah yang menyebutkan bahwa naskah adalah hasil penelitian asli, belum pernah dan tidak sedang diterbitkan di tempat lain serta bebas dari konflik kepentingan.

#### **Penelitian yang melibatkan hewan dan manusia**

Setiap naskah yang penelitiannya melibatkan hewan (terutama mamalia) dan manusia sebagai obyek percobaan/penelitian, wajib menyertakan '*ethical clearance approval*' yang dikeluarkan oleh badan atau pihak berwenang.

#### **Lembar ilustrasi sampul**

Gambar ilustrasi yang terdapat di sampul jurnal Berita Biologi berasal dari salah satu naskah yang dipublikasi pada edisi tersebut. Oleh karena itu, setiap naskah yang ada ilustrasinya diharapkan dapat mengirimkan ilustrasi atau foto dengan kualitas gambar yang baik dengan disertai keterangan singkat ilustrasi atau foto dan nama pembuat ilustrasi atau pembuat foto.

#### **Proofs**

Naskah *proofs* akan dikirim ke penulis dan penulis diwajibkan untuk membaca dan memeriksa kembali isi naskah dengan teliti. Naskah proofs harus dikirim kembali ke redaksi dalam waktu tiga hari kerja.

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