TROPICS · Vol. 10 (3): 325-352 Issued March 5, 2001

Epilachnine Ladybird Beetles (Coleoptera, Coccinellidae) of Sumatra and Java

Haruo KATAKURA Division of Biological Sciences, Graduate School of Science, Hokkaido University, Sapporo 060-0810, Japan
Susumu NAKANO Division of Biological Sciences, Hiroshima Shudo University, Hiroshima 731-3195, Japan
Sih KAHONO Balai Penelitian dan Pengembangan Zoologi, Puslitbang Biologi, LIPI, Jl. Raya Bogor Jakarta Km 46, Cibinong 16911, Indonesia
Idrus ABBAS Jurusan Biologi, FMIPA, Universitas Andalas, Limau Manis, Padang, Sumatera Barat, Indonesia
Koji NAKAMURA Ecological Laboratory, Faculty of Science, Kanazawa University, Kanazawa 920-1192, Japan

ABSTRACT Twenty-six species of epilachnine ladybird beetles confirmed in Sumatra and Java during 1981-1998 were enumerated and figured. They included eleven species of *"Henosepilachna"*, thirteen species of *"Epilachna"*, one species of *Afidenta*, and one species whose taxonomic status was not settled. Records of food plants were given for each species, and brief notes were added concerning some aspects of their natural history.

Key words: Epilachninae / food plants / Java / Sumatra.

Ladybird beetles of the phytophagous subfamily Epilachninae are rich and abundant in Indonesia. They include serious pests of various important crops such as eggplant, potato, and squash (Gunst, 1957; Kalshoven, 1981). However, the taxonomy of the Indonesian epilachnines is not yet in a satisfactory state. Although many "species" were recorded from Indonesia by earlier authors (Mulsant, 1850; Korschefsky, 1931; Dieke, 1947), taxonomic identity of these previously recorded species is often not clear. There exist only a few reliable taxonomic studies for the Indonesian species after the publication of Dieke's revision (Dieke, 1947) of Eurasian and Australian epilachnines (Bielawski, 1959; Fürsch, 1959; Richards, 1983; Katakura *et al.*, 1988). Under such circumstance, accurate identification of species, which is indispensable for any ecological or evolutionary study, is often very difficult.

In the present paper, we try to fulfill such a gap of information by enumerating epilachnine species confirmed by us or by our colleagues during 1981-1998 in Sumatra and Java. The Sumatran specimens are those mainly obtained in West Sumatra (Padang and the vicinity), and Javanese forms are those mainly obtained in West Java (Bogor, Mt. Gede, and the vicinity). Specimens confirmed in

central and eastern parts of Java are also incorporated. A total of 26 species are treated. For the convenience of identification, patterns of pronotal and elytral maculation are figured for each species. Genitalia of both sexes are also figured.

About three fifth of the species are cited with scientific names. However, except for very common species such as *Epilachna vigintioctopunctata*, the adoption of scientific names is provisional, leaving further confirmation on a sound taxonomic basis. The remaining species, apparently including some undescribed species, are referred to by species-specific code numbers or code letters, which have been used in our previous papers (Katakura *et al.*, 1994a; Nakamura *et al.*, 1995).

Thus, the present paper does not intend to treat formally the taxonomy of the species concerned. The full account of the taxonomy of the present material, including the descriptions of undescribed species, will be treated elsewhere. Rather, the present paper aims to provide basic information for ecological and evolutionary studies of Indonesian epilachnines.

Generic classification of Asian species of epilachnines is controversial. A majority of Asian epilachnines were previously assigned to two large genera, *Epilachna* Dejean** (*sens*. Li & Cook, 1961 = *Afissa* Dieke, 1947) and *Henosepilachna* Li (= *Epilachna sens*. Dieke, 1947). The former was chiefly characterized by toothless tarsal claws and the sixth visible abdominal sternite of the female being not split, whereas the latter by toothed tarsal claws and divided sixth sternite. However, Iablokoff-Khanzorian (1980) and Richards (1983) synonymized *Henosepilachna* with *Epilachna*, regarding the characters that were said to separate these two groups as not reliable. Some agreed with their synonymy (Katakura *et al.*, 1988) while others still treated them as two separate genera (Fürsch, 1990, 1991; Li, 1993; Canepari & Milanese, 1997).

Our experience with Indonesian epilachnines leads us to accept *Henosepilachna* as a well-defined monophyletic group worthy to be treated as a distinct genus. However, *Epilachna sens*. Li & Cook seems to be rather heterogeneous with respect to the morphology of the genitalia of both sexes (Dieke, 1947), and female internal reproductive systems (Katakura *et al.*, 1994a). Shapes of eggs and oviposition sites are also diverse within *Epilachna* (Nakano *et al.*, 2001; our unpublished data). Therefore, the view that there are "two" big groups in Asian epilachnines is not correct. Actually Asian epilachnines are composed of one big group (= *Henosepilachna*) and an assemblage of various species with diverse characteristics. Therefore, we tentatively place species of both *Epilachna* (*sens*. Li & Cook, 1961) and *Henosepilachna* in *Epilachna* (*sens*. Richards, 1983) in the present paper. But the species belonging to *Henosepilachna* and *Epilachna* (*sens.* Li & Cook, 1961) are respectively indicated as *"Henosepilachna"* and *"Epilachna"* when necessary.

Our material includes eleven species of *"Henosepilachna"* and thirteen species of *"Epilachna"*, together with one species of *Afidenta* Dieke, the genus that was characterized by toothed tarsal claws and undivided sixth female sternite. Another species, whose taxonomic position is not yet settled, is also included.

Food plants of the Indonesian epilachnines are also given whenever possible. They are summarized in Table 1. Certain relationships were noticed between taxonomic groups of epilachnines and taxonomy of their food plants as mentioned later. In Table 1, some species of food plants so far not determined are cited by the code numbers used by us.

** The authorship of *Epilachna* is still under debate. In the present paper we follow Pope (1992) for the authorship of the genus.

ENUMERATION

Remarks

1) As an index of body size, the range of body length is given for each species that was measured on some selected specimens. Since dried specimens were often distorted, measurement of the body length must have involved a considerable observational error. Hence, these values should not be accepted as accurate indexes of body size.
2) Elytral spots are numbered following the systems given by Dieke (1947).
3) "Material examined" section cites adult specimens dissected for identification. Names of collectors are given in parentheses. All the specimens are tentatively deposited in the Division of Biological Sciences, Graduate School of Science, Hokkaido University. A part of them will be placed in the collection of the Bogor Zoological Museum, Bogor, and in the Department of Biology, Faculty of Science, Andalas University, Padang, Indonesia. Immature stages were also collected for some species, but their morphology is not treated below.

Species with toothed tarsal claws and the sixth visible abdominal sternite of the female being split (= *"Henosepilachna"*)

***Epilachna vigintioctopunctata* (Fabricius)** (Figs. 1, 2, 36, 58)

Morphology, biology, geographic distribution, and geographic variation of this species in West Sumatra were reported by Katakura *et al.* (1988, 1994b), and Abbas *et al.* (1988). No noticeable difference was detected between Sumatran and Javanese specimens except for the variation trend of elytral maculation.

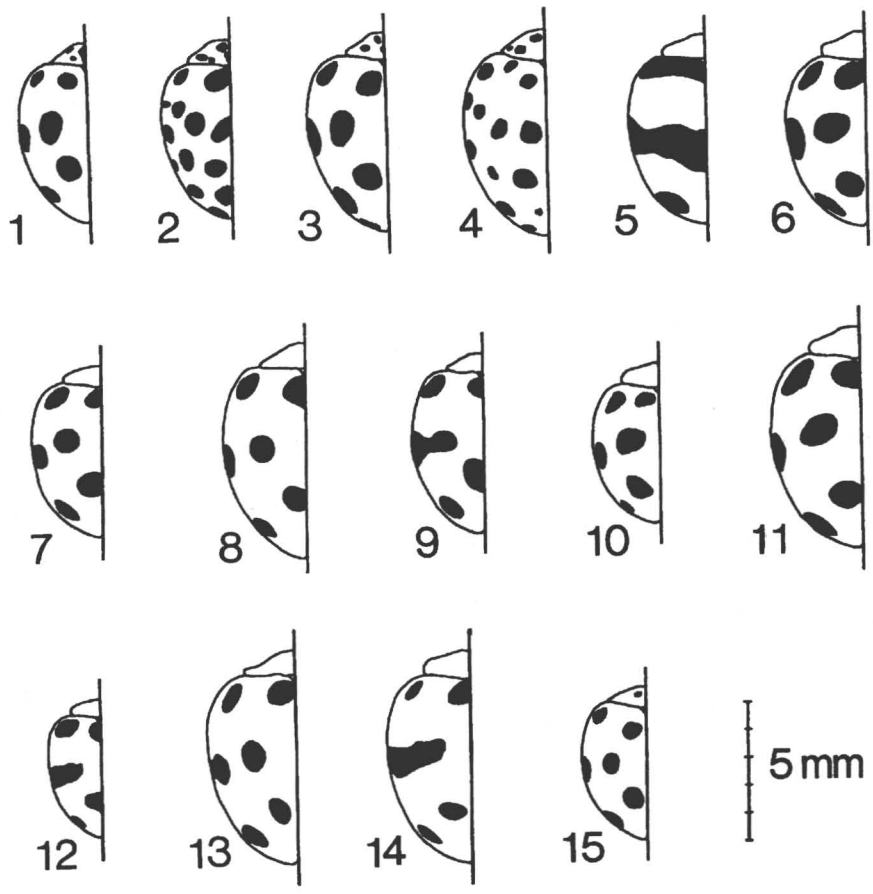
Maculation (Figs. 1, 2). Head spotless. Pronotum spotless or with two to seven spots or black except for front margin. Elytral spots variable in Sumatran and Javanese populations, from six to 13 (very rarely 14) spots on each elytron. Confluence of various spots also occurs. For the variation of elytral spots in West Sumatra, see Abbas *et al.* (1988) and Katakura *et al.* (1994b). The number of elytral spots tended to increase with the increase of altitude, whereas variation of spot confluence behaved differently. Spot variation in Java seems somewhat different from that in Sumatra, but it is not yet analyzed.

Genitalia. Male, Fig. 36; female, Fig. 58 (Katakura *et al.*, 1988).

Size. Individuals on solanaceous plants (Katakura *et al.*, 1988): Male (N = 94), 5.8-7.0 mm; female (N = 87), 6.0-8.1 mm. Those collected on *Centrosema pubescens* (see "Remarks"): Male (N = 6), 5.4-6.1 mm; female (N = 8), 6.1-7.0 mm.

Additional material examined after Katakura et al. (1988). Sumatra: Foot of Mt. Rasam, 1♀, July 19, 1989 (Asril); Padang Panjang, 2♀♀, Oct. 23, 1988 (S. Nakano), 1♂, Nov. 11, 1990 (H. Katakura); Simpang Empat, 5♂♂4♀♀, March 5, 1989 (Zaldi *et al.*); Lubuk Minturun, 1♂2♀♀, March 23, 1989 (S. Nakano). Java : Bogor, 3♂♂4♀♀, March 3, 1987 (Soenartono).

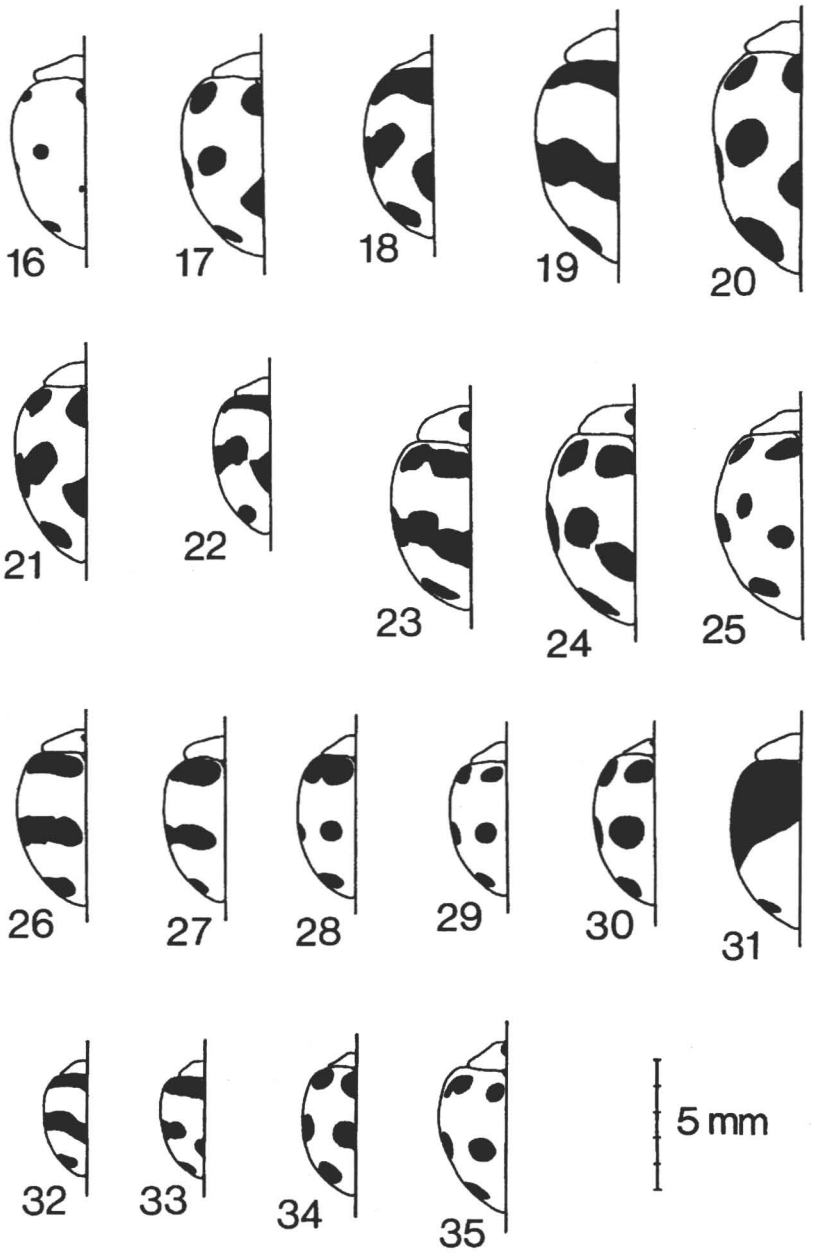
Remarks. This species is one of the commonest and most widespread epilachnines in Southeast Asia (Richards, 1983), found on various kinds of crops and weeds belonging to Solanaceae (Table 1). Most important host plants of this species in Indonesia may be eggplants and a weed, *Solanum torvum* (rimbang [Sumatra] or takokak [Sunda] or pokak [Java] in local languages). In both West Sumatra and



Figs. 1-15. Spot patterns of pronotum and left elytron in *"Henosepilachna"* (1-14) and *Afidenta* (15). 1, 2, *E. vigintioctopunctata*; 3, *E. pusillanima*; 4, *E. septima*; 5, *E. bifasciata*; 6, *E. sumatrensis*; 7, *E.* sp. 3; 8, 9, *E. pytho*; 10, *E. boisduvali*; 11, *E.* sp. 4; 12, *E.* sp. 5; 13, 14, *E. enneasticta*; 15, *Afidenta misera*.

Java, this species was common everywhere in the rural areas. No individuals of this species have been collected in forest habitats (Table 2).

After the publication of Katakura *et al.* (1988) and Abbas *et al.* (1988), we found epilachnine beetles occurring on a herbaceous vine weed, *Centrosema pubescens*. The beetles on the legume, which were discovered in Padang (West Sumatra) and Bogor (West Java), are smaller in size than *E. vigintioctopunctata* on solanaceous plants, but otherwise the former is morphologically very similar to the latter (for the size difference between individuals on solanums and those on *Centrosema*, see Nishida *et al.*, 1997). Host preferences of legume feeding beetles appeared to be different from solanum feeding beetles (Nishida *et al.*, 1997). The legume beetles are treated here as *E. vigintioctopunctata*. Infestation of *C. pubescens* by *E. vigintioctopunctata* has recently been confirmed in Prambanan, Central Java by one of us (S. Kahono) and also in the peninsular part of Malaysia (Y. Shirai, pers. comm.). On the other hand, no epilachnines have been found on the legume



Figs. 16-35. Spot patterns of pronotum and left elytron in *"Epilachna"* (sens. Li; 16-34) and *E.* sp. C (35). 16-19, *E. alternans*; 20, *E.* sp. L; 21, *E.* sp. I; 22, *E.* sp. F; 23, 24, *E. decipiens*; 25, *E.* sp. M; 26, *E.* sp. G; 27, *E. orthofasciata*; 28, a Sumatran form of *"E. orthofasciata"*; 29, *E.* sp. K; 30, *E.* sp. B; 31, *E.* sp. J; 32, 33, *E. gedeensis*; 34, *E. incauta*.

in East Java (Table 1), and at the places higher than approximately 400 m above the sea level in the vicinity of Padang, West Sumatra (T. Nishida, pers. comm.).

On an occasion in the strong drought of 1997 in Bogor when the host plant (*S. torvum*) was heavily damaged by *E. vigintioctopunctata*, we observed that some adult beetles fed on *Chromolaena*

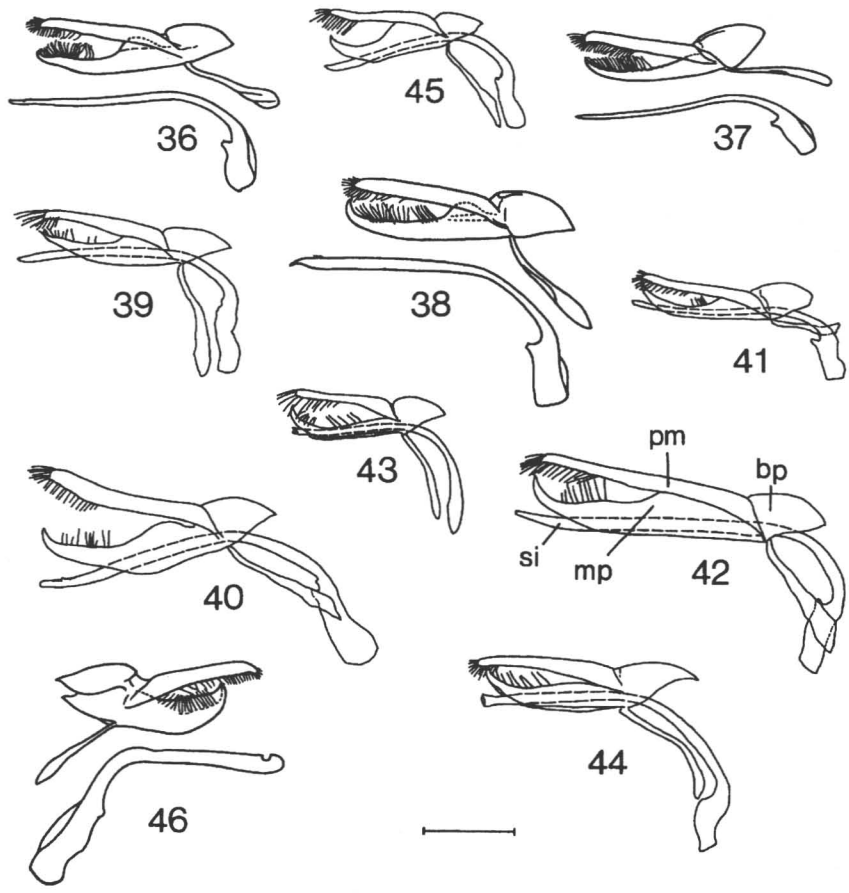
Table 1. Food plants of Indonesian epilachnine ladybird beetles confirmed by the present study. Areas where the occurrence of the beetles on the plant species is confirmed are also shown.

	Food plant		Java			Sumatra
Beetles	Species	Family[1)]	W.Java	C.Java	E.Java	W. Sumatra
E. vigintioctopunctata	*Solanum aethiopicum*	Sol.				+
	S. americanum	Sol.	+	+	+	+
	S. capsicoides	Sol.	+	+	+	+
	S. erianthum	Sol.	+	+	+	+
	S. jamaicaense	Sol.				+*
	S. macrocarpon	Sol.				+
	S. mammosum	Sol.	+	+	+	+
	S. melongena	Sol.	+	+	+	+
	S. nigrum	Sol.	+	+	+	
	S. pseudocapsicum	Sol.	+	+	+	+
	S. torvum	Sol.	+	+	+	+
	S. triflorum	Sol.			+	
	S. tuberosum	Sol.	+	+	+	+
	S. sp. 1	Sol.	+	+	+	
	S. sp. 2	Sol.	+	+		
	Brugmansia candida	Sol.	+	+	+	
	B. suaveolens	Sol.	+	+	+	+
	B. sp. 1	Sol.		+		
	Datura metel	Sol.	+	+	+	
	Lycopersicon esculentum	Sol.	+	+	+	+
	Physalis perviana	Sol.	+	+	+	
	P. sp.	Sol.				+
	Centrosema pubescens	Leg.	+	+		+
	Chromolaena odorata	Com.	+			
E. pusillanima	*Cucurbita moschata*	Cuc.				+
	Cucumis sativus	Cuc.	+	+	+	+
	Benincasa hispida	Cuc.				+
	Luffa acutangula	Cuc.	+	+	+	+
	L. aegyptica	Cuc.		+		
	Sechium edule	Cuc.	+			+
	Citrullus lanatus	Cuc.			+	
	Gymnopetalum chinense	Cuc.				+
	Cucurbitaceae sp. 1	Cuc.		+	+	
E. septima	*Momordica charantia*	Cuc.	+	+	+	+
	M. subangulata	Cuc.			+	
E. bifasciata	*S. americanum*	Sol.	+			
	Lycianthes sp.	Sol.	+			
E. sumatrensis	*Solanum* sp.	Sol.				+
E. sp. 3	*Mikania* sp.	Com	+			+
	Leucas lavandulifolia	Lab.	+	+	+	
	Labiatae sp. 1	Lab.			+	
E. pytho	*Sechium edule*	Cuc.				+
	Gynostemma pentaphyllum	Cuc.				+
	Mukia javanica	Cuc.				+
	Trichosanthes ovigera	Cuc.				+
	T. tricuspidata	Cuc.	+			+
	T. sp. 7	Cuc.	+			
E. boisduvali	*Mukia javanica*	Cuc.				+
E. sp. 4	*Trichosanthes ovigera*	Cuc.				+
	Mukia javanica	Cuc.				+
E. sp. 5	*Strobilanthes cernuus*	Aca.	+			

	Acanthaceae sp. 1	Aca.				+	
E. enneasticta	*S. aethiopicum*	Sol.				+	
	S. americanum	Sol.	+	+		+	
	S. capsicoides	Sol.	+	+		+	
	S. erianthum	Sol.	+			+	
	S. melongena	Sol.				+	
	S. lasiocarpum	Sol.				+	
	S. pseudocapsicum	Sol.		+		+	
	S. torvum	Sol.	+			+	
	S. tuberosum	Sol.				+	
	S. sp. 2	Sol.		+			
	S. sp. 3	Sol.			+		
	Lycianthes denticulatum	Sol.				+	
	Brugmansia suaveolens	Sol.				+	
	B. candida	Sol.	+	+			
E. alternans	*Sechium edule*	Cuc.				+	
	Cucurbita moschata	Cuc.				+	
	Zehneria maysorensis	Cuc.				+	
	Trichosanthes ovigera	Cuc.				+	
	Gynostemma sp.	Cuc.	+			+	
	Melothria mucronata	Cuc.	+	+	+		
	Trichosanthes sp. 6	Cuc.	+				
	Trichosanthes sp. 7	Cuc.	+				
	Cucurbitaceae sp. 4	Cuc.	+				
	Cucurbitaceae sp. 9	Cuc.	+				
E. sp. I	Compositae sp.	Com.				+	
E. sp. L	(Unknown)	-				+	
E. sp. F	*Gynostemma* sp.	Cuc.	+				
	Cucurbitaceae sp.	Cuc.	+				
E. decipiens	*Clematis lechenaultiana*	Ran.	+				
E. sp. M	(Unknown)	-				+	
E. sp. G	*Clematis lechenaultiana*	Ran.	+				
E. orthofasciata	*Tetrastigma papilosum*	Vit.	+				
E. ?orthofasciata	Vitaceae sp.	Vit.				+	
	Saurauia sp.	Act.				+	
	Actinidia sp.	Act.				+	
E. sp. K	*Cissus modesta*	Vit.	+				
E. sp. B	*Cayratia* sp.	Vit.				+	
E. sp. J	(Unknown)	-				+	
E. gedeensis	*Elatostema acuminata*	Urt.	+				
	Elatostema strigosum	Urt.	+				
E. ?gedeensis	*Elatostema* sp.	Urt.			+		
	Urticaceae spp.	Urt.			+		
E. incauta	*Boehmeria macrophylla*	Urt.	+	+		+	
	Leucosyke candidissima	Urt.	+				
	Villebrunea sp.	Urt.				+	
	Debregeasia wallichiana	Urt.				+	
	Urticaceae sp. 1	Urt.		+			
	Urticaceae sp. 2	Urt.		+			
Afidenta misera	*Desmodium* sp. 1	Leg.	+	+			
	Desmodium sp. 2	Leg.		+			
E. sp. C	*Linociera* sp.	Ole.				+	

[1] Aca., Acanthaceae; Act., Actinidiaceae; Com., Compositae; Cuc., Cucurbitaceae; Lab., Labiatae; Leg., Leguminosae; Ole., Oleaceae; Ran., Ranunculaceae; Sol., Solanaceae; Urt., Urticaceae; Vit., Vitaceae.

* Confirmed only in South Sumatra.



Figs. 36-46. Male genitalia of *"Henosepilachna"*. 36, *E. vigintioctopunctata*; 37, *E. pusillanima;* 38, *E. septima;* 39, *E. bifasciata*; 40, *E. sumatrensis*; 41, *E.* sp. 3; 42, *E. pytho* (pm, paramere; mp, median piece of tegmen; bp, basal piece of tegmen; si, sipho); 43, *E. boisduvali;* 44, *E.* sp. 4; 45, *E.* sp. 5; 46, *E. enneasticta*. Scale bar = 1 mm. Figs. 36-38 and 46 were reproduced from Katakura *et al.* (1988).

odorata (Compositae) and on a species of Urticaceae. No such abnormal feedings have been observed afterward.

***Epilachna pusillanima* Mulsant** (Figs. 3, 37, 59)

Morphology, biology, and geographic distribution of this species in West Sumatra were treated in Katakura *et al.* (1988) under the name *Epilachna dodecastigma* (Wiedemann). No noticeable difference was detected between Sumatran and Javanese specimens.

Maculation (Fig. 3). Head spotless. Pronotum spotless or with two or four spots. Elytron usually with six or seven (persistent spots plus spot *h*) but rarely up to 13 spots.

Genitalia. Male, Fig. 37; female, Fig. 59 (Katakura *et al.*, 1988).

Size. Male (N = 8), 6.6-6.9 mm; female (N = 5), 7.3-7.8 mm (Katakura *et al.*, 1988).

Additional material examined after Katakura et al. (1988): Sumatra: Padang Panjang, 6♂♂3♀♀,

Jan. 15, 1989 (Zaldi & S. Nakano), 1♀, Jan. 26, 1989 (Zaldi), 1♀, Dec. 28, 1988, 1♂, Dec. 26, 1988 (Zaldi), 10♂♂5♀♀, Nov. 11, 1990 (H. Katakura & Asril); Limau Manis, 1♂1♀, Dec. 1988 (S. Nakano), 3♂♂, Jan. 18, 1990 (S. Nakano); 1♀, Mt. Tandikat, Sept. 20, 1987 (I. Abbas); Sitiung, 1♂, Nov. 13, 1990 (H. Katakura); Bukit Sabalah, 1♀, Nov. 12, 1990 (H. Katakura); Sukarami, Kebun Gadang, Bukit Gompong, 2♀♀, Jan. 27, 1994 (S. Nakano). Java: Sukamantri, 1♀, Nov. 26, 1990 (S. Kahono); Kebun Raya Bogor, 1♂1♀, Oct. 18, 1990 (H. Katakura), 2♂♂, Oct. 26, 1990 (H. Katakura); Sindangbarang, 1♂1♀, Oct. 25, 1991 (H. Katakura); Cangar, Batu, East Java, 1♂1♀, Jan. 4, 1994 (S. Kahono).

Remarks. Katakura *et al.* (1988, 1994a) referred to this species as *E. dodecastigma* (Wiedemann). Since the type specimen of Wiedemann's *Coccinella dodecastigma* has been missing and so its identity is still ambiguous (Booth & Pope, 1989), we use here the name *E. pusillanima* for the present species.

This species is also a dweller of disturbed habitats, being found on various kinds of cucurbitaceous crops and weeds except bitter cucumber (*Momordica charantia*), on which *E. septima* occurs (Table 1). Thus, these two pest species of cucurbits usually do not coexist on the same plants in nature.

Epilachna pusillanima is widespread in Southeast Asia (Li & Cook, 1961; Pang & Mao, 1979; Hoàng, 1983; Katakura *et al.*, 1988; Nakano & Katakura, 1999). It is sometimes misidentified with *E. vigintioctopunctata* in Southeast Asia (Shirai & Katakura, 1999), from which it is discernible by the morphological features of the genitalia of both sexes (Figs. 36 vs. 37, and 58 vs. 59) and the food plants: *E. pusillanima* is confined to cucurbits while *E. vigintioctomaculata* is found exclusively on solanaceous plants and the legume *Centrosema pubescens*.

***Epilachna septima* Dieke** (Figs. 4, 38, 60)

Morphology, biology, and geographic distribution of this species in West Sumatra were reported by Katakura *et al.* (1988). No noticeable differences were detected between Sumatran and Javanese specimens.

Maculation (Fig. 4). Head spotless. Pronotum with two to six spots. Elytron usually with 14 spots but sometimes lacking spots *e*, *f*, *g* or *h*.

Genitalia. Male, Fig. 38; female, Fig. 60 (Katakura *et al.*, 1988).

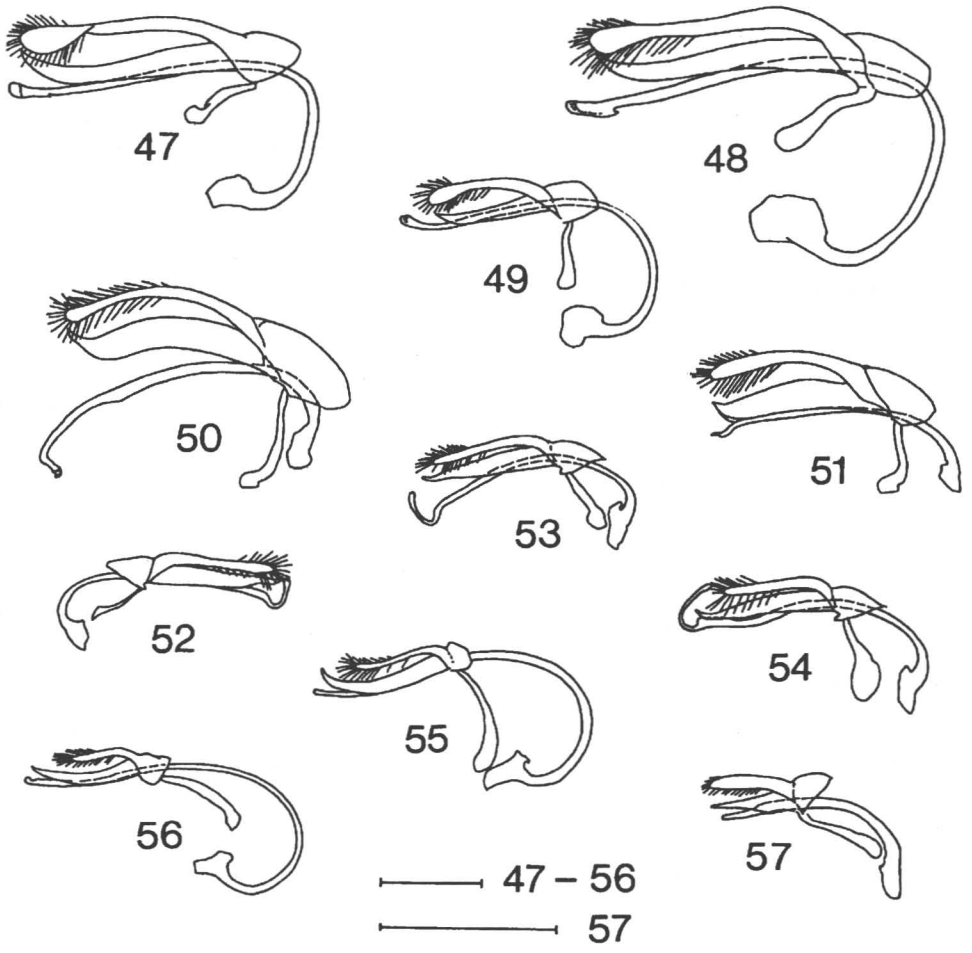
Size. Male (N = 7), 6.5-7.2 mm; female (N = 6), 7.0-7.7 mm (Katakura *et al.*, 1988).

Additional material examined after Katakura et al. (1988). Java: Sindangbarang, 3♂♂1♀, Oct. 20, 1990 (H. Katakura; collected as larvae, reared to adults in laboratory), 2♂♂4♀♀, Oct. 25, 1991 (H. Katakura); Bantul, Parangtritis, 20m, 2♂♂, May 11, 1998 (S. Kahono); Wonogiri, Irimoko, 3♀♀, Aug. 19, 1997 (S. Kahono).

Remarks. This species seems to specialize to bitter cucumber (*Momordica charantia,* "pario" [Padang] or "paria" [Sunda] or "pare" [Java] in local languages) (Katakura *et al.*, 1988), and to "wild bitter cucumber" *M. subangulata* (the present study; Table 1). We did not collect this species from other plants.

***Epilachna bifasciata* (Fabricius)** (Figs. 5, 39, 61)

Maculation (Fig. 5). Head and pronotum spotless. Scutellum light. Elytra with two transverse fasciae



Figs. 47-57. Male genitalia of *"Epilachna"* and *Afdenta*. 47, *E. alternans*; 48, *E.* sp. I; 49, *E.* sp. F; 50, *E. decipiens*; 51, *E.* sp. G; 52, *E. orthofasciata*; 53, *E.* sp. K; 54, *E.* sp. B; 55, *E. gedeensis*; 56, *E. incauta*; 57, *Afidenta misera*. Scale bar = 1 mm.

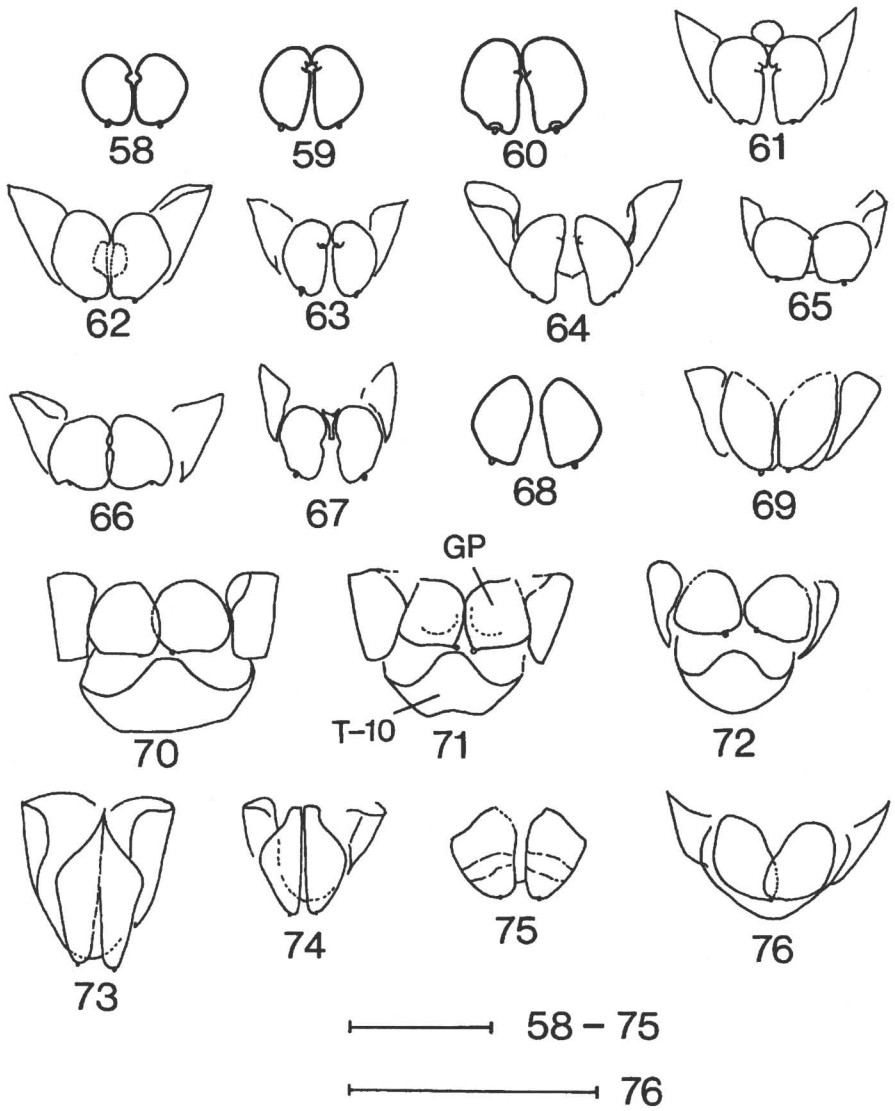
and a pair of apical spots (no. 6). Basal fascia touching the base; medial fascia reaching the margin.

Genitalia. Male, Fig. 39; female, Fig. 61.

Size. Male (N = 6), 5.7-7.0 mm; female (N = 8), 6.6-7.3 mm.

Material examined. Java: Mt. Gede, 5♀♀, Nov. 28, 1990 (S. Kahono & H. Katakura), 4♂♂, Jan. 29, 1991 (S. Kahono), 1♂, Oct. 31, 1991 (H. Katakura), 1♂2♀♀, Nov. 5, 1993 (H. Katakura & S. Kahono); 1♂, Jan., 1994 (S. Nakano; collected as larva and reared in laboratory); 1♂, Sept. 5, 1995 (S. Nakano); Cibulnunggul, Kalapanunggal, 1♀, Nov. 4, 1994 (F. Ito).

Remarks. This species is so far known only in W. Java (Dieke, 1947 as *Epilachna parafasciata*; Bielawski, 1965). We collected larvae and adults of this species from *Solanum americanum* and *Lyciantes* sp. at Mt. Gede (Table 1). Elytral markings are very similar to those of two other sympatric species, *E.* sp. G (Fig. 26) and *E. orthofasciata* (Fig. 27). The elytral ground color is brownish in *E.*



Figs. 58-76. Female genitalia. 58, *E. vigintioctopunctata;* 59, *E. pusillanima;* 60, *E. septima;* 61, *E. bifasciata*; 62, *E. sumatrensis*; 63, *E.* sp. 3; 64, *E. pytho*; 65, *E. boisduvali*; 66, *E.* sp. 4; 67, *E.* sp. 5; 68, *E. enneasticta;* 69, *E. alternans;* 70, *E. decipiens*; 71, *E.* sp. M (T-10, tergite X; GP, genital plate); 72, *E.* sp. G; 73, *E. orthofasciata*; 74, *E. gedeensis*; 75, *E.* sp. C; 76, *Afidenta misera*. Scale bar = 1 mm. Figs. 58-60 and 68 were reproduced from Katakura *et al.* (1988).

bifasciata and *E.* sp. G, while reddish in *E. orthofasciata*.

***Epilachna sumatrensis* Fürsch** (Figs. 6, 40, 62)

Maculation (Fig. 6). Head and pronotum spotless, scutellum light. Elytron with 6 spots; spots 1 may or may not touch the suture; spot 4 touching margin.

Genitalia. Male, Fig. 40; female, Fig. 62.

Size. Male (N = 3), 6.9-7.2 mm; female (N = 3), 7.0-7.2 mm.

Material examined. Sumatra: Kayu Jao, 1♀, Dec. 13, 1988 (S. Nakano); Air Sirah, 2♂♂2♀♀, Nov. 8, 1990 (H. Katakura), 1♂, Jan. 20, 1994 (S. Nakano).

Remarks. We collected adults and pupae of this species from a severely infested plant of an unidentified solanaceous species in Sumatra. They fed on leaves of *Solanum torvum* under laboratory conditions. This species was first described from Sumatra (Fürsch, 1959). Bielawski (1980) recorded it from the Philippines.

***Epilachna* sp. 3** (Figs. 7, 41, 63)

Maculation (Fig. 7). Head and pronotum spotless. Scutellum light. Elytron with 6 spots; spots 1 and 5 partly or entirely fused with their counterparts on suture; spot 4 may or may not reach margin. Elytral spot patterns seemed more variable in specimens collected from Central and East Java than those from West Java.

Genitalia. Male, Fig. 41; female, Fig. 63.

Size. Male (N = 8), 5.5-6.2 mm; female (N = 7), 6.2-6.6 mm.

Material examined. Sumatra: Simpang Empat, 4♂♂2♀♀, March 5, 1989 (Zaldi *et al.*); Gunung Medan, 1♀, Nov. 12, 1990 (H. Katakura). Java: Cibodas, 2♂♂1♀, Nov. 1, 1990 (H. Katakura & S. Kahono); Pagelaran, Bogor, 3♂♂3♀♀, Oct. 19, 1990 (H. Katakura *et al.*); Mt. Salak, 1♂, Jan. 10, 1994 (S. Nakano), 1♀, Nov. 18. 1994 (H. Katakura & S. Kahono); Halimun, 1,100m, 1♀, Sept. 7, 1996 (S. Kahono); Cibulnunggul, Kalapanunggal, 1♂1♀, Nov. 4, 1994 (H. Katakura & S. Kahono); Pacitan, 10m, 1♂2♀♀, Apr. 24, 1998 (S. Kahono); Klaten, 100m, 3♂♂3♀♀, Jan. 16, 1997 (S. Kahono); Purwodadi, 1♂, Sept. 1, 1995 (S. Nakano).

Remarks. This species is closely similar to *E. emarginata* Dieke in the morphology of genitalia and elytral pattern, but the former has rounded elytral tip whereas the latter has distinctly angulated one (Dieke, 1947). In West Sumatra, this species was collected from a herbaceous weed, *Mikania micrantha.* In and around Bogor, West Java, too, this species is common on the same, or a congeneric plant species. All the immature stages have been confirmed on *Mikania* in Bogor.

This species also occurs on two species of Labiatae; on *Leucas lavandulifolia* in Bogor and in Central Java, and on Labiatae sp. in Purwodadi (East Java) (Table 1). It seems that the utilization by *E.* sp. 3 of Labiatae species increases, and that of *Mikania* decreases from West Java through Central to East Java.

Population dynamics of this species in the Bogor Botanic Gardens is now under investigation (see Nakamura *et al.*, 1992).

***Epilachna pytho* Mulsant** (Figs. 8, 9, 42, 64)

Maculation (Figs. 8, 9). Head and pronotum spotless. Scutellum light. Elytron with 6 spots; spot 1 with its counterpart forming one rounded spot bisected by the suture; spot 5 also on suture or reaching it; spot 4 touching margin; in 1 male specimen collected at Cibodas, Java, spots 3 and 4 fused (Fig. 9) and in two individuals from Mt. Salak, spots 3 and 5 were united.

Genitalia. Male, Fig. 42; female, Fig. 64.

Size. Male (N = 8), 6.1-7.5 mm; female (N = 9), 6.4-7.8 mm

Material examined. Sumatra: Kayu Jao, 1♂1♀, Sept. 25, 1988 (S. Nakano), 4♂♂3♀♀, date unknown (S. Nakano; collected as eggs, reared in laboratory); Padang Panjang, 1♀, Jan. 15, 1989

(Zaldi); Air Sirah, 1♂, Nov. 24, 1989 (S. Nakano), 2♀♀, Nov. 13, 1990 (Asril), 3♀♀, Nov. 8, 1990 (Asril & H. Katakura), 1♂1♀, Jan. 20, 1994 (Asril); Mt. Gadut, 2♂♂, May 4, 1989 (S. Nakano); Pinang Pinang, Padang, 1♀, Aug. 26, 1998 (S. Nakano); Sukarami, 2♂♂, Aug. 24, 1995, 1♀, Aug. 25, 1995 (S. Nakano). Java: Cibodas, 1♂, Oct. 31, 1990 (K. Nakamura); Halimun, Malasari, 1000m, 1♀, Sep. 5, 1996 (S. Kahono); Mt. Salak, 1♂, Nov. 26, 1993 (H. Katakura & S. Kahono), 3♂♂2♀♀, Jan. 1, 1994 (S. Nakano; part of them collected as larvae and reared to adults in laboratory), 1♂1♀, Nov. 18, 1994 (H. Katakura & S. Kahono); Cibulnunggul, Kalapanunggal, 1♂, Nov. 4, 1994 (H. Katakura).

Remarks. Sumatran specimens are somewhat larger than Javanese specimens. This species had been collected often together with another cucurbit feeding species, *E. alternans*, in and near Padang, Sumatra, and in Mt. Salak, West Java. The two species are very similar in external appearance in spite of their remote taxonomic relationship (compare Figs. 8 and 17).

***Epilachna boisduvali* Mulsant** (Figs. 10, 43, 65)

Maculation (Fig. 10). Head and pronotum spotless. Scutellum light. Elytron with 6 spots; spots 1 and 2 of both elytra arranged on a straight line. All spots free from base, suture or margin.

Genitalia. Male, Fig. 43; female, Fig. 65.

Size. Male (N = 1), 5.7 mm; female (N = 2), 6.4-6.6 mm.

Material examined. Sumatra: Padang Panjang, 1♂1♀, Jan. 15, 1989 (S. Nakano), 1♀, Jan. 31, 1989 (S. Nakano); Sukarami, 1♀, Aug. 21, 1998 (S. Nakano).

Remarks. Only four specimens listed above are available for the present study. Of these, three specimens were collected at the same site from a cucurbit, *Mukia javanica*.

***Epilachna* sp. 4** (Figs. 11, 44, 66)

Maculation (Fig. 11). Head and pronotum spotless. Scutellum light. Elytron with 6 spots; spot 1 of both elytra fused on suture; spot 4 touching margin. In two individuals the spot 5 faint.

Genitalia. Male, Fig. 44; female, Fig. 66.

Size. Male (N = 3), 7.0-7.4 mm; female (N = 2), 7.4-8.0 mm.

Material examined. Sumatra: Air Sirah, 1♂, Jan. 4, 1990 (S. Nakano), 1♀, Oct. 25, 1988 (S. Nakano); Sukarami, 2♂♂1♀ (S. Nakano).

Remarks. This species is also a cucurbit feeder. Judging from the characteristic features of the male genitalia (in particular apex of sipho), this species is likely new to science.

***Epilachna* sp. 5** (Figs. 12, 45, 67)

Maculation (Fig. 12). Head and pronotum spotless. Scutellum light. Elytron with 6 spots; spot 1 and 5 fused with their counterparts on suture forming large spots; spot 4 reaching margin. Javanese specimens invariably possess spots 3 and 4 being fused to form a fascia.

Genitalia. Male, Fig. 45, no hairs on median piece of tegmen; female, Fig. 67.

Size. Male (N = 4), 4.5-4.7 mm; female (N = 6), 4.9-5.8 mm.

Material examined. Sumatra: Kayu Jao, 1♀, Sept. 25, 1988 (S. Nakano). Java: Mt. Gede, 1♂2♀♀, Jan. 29, 1991 (S. Kahono); 3♂♂4♀♀, Oct. 29-31, 1991 (H. Katakura & S. Kahono); Halimun, Malasari, 1000m, 1♀, May 9, 1996 (S. Kahono).

Remarks. In both Sumatra and Java, this species was collected on Acanthaceae, of which Javanese species was identified with *Strobilanthes cernuus*. The Sumatran specimen (female) is larger (5.8 mm) than the Javanese specimens. In Mt. Gede, the present species is very similar in the spot pattern and body size to sympatric *E. gedeensis* (Figs. 32, 33) despite their rather remote taxonomic relationship.

***Epilachna enneasticta* Mulsant** (Figs. 13, 14, 46, 68)

Morphology, biology, and geographic distribution of this species in West Sumatra were reported by Katakura *et al.* (1988).

Maculation (Figs. 13, 14). Head and pronotum spotless. Elytron with 6 spots. Javanese specimens differ from Sumatran ones in the pattern of elytral maculation as shown in Figs. 13 and 14.

Genitalia. Male, Fig. 46; female, Fig. 68 (Katakura *et al.*, 1988).

Size. Male (N = 20), 7.2-8.0 mm; female (N = 16), 7.2-8.5mm (Katakura *et al.*, 1988).

Additional material examined after Katakura et al. (1988). Sumatra: Air Sirah, 2♂♂2♀♀, Sept. 6, 1988 (S. Nakano), 1♂, Nov. 8, 1988 (S. Nakano), 1♂, Feb. 3, 1989 (S. Nakano), 1♂, Nov. 13, 1990 (H. Katakura); Padang Panjang, 1♂, Nov. 11, 1990 (H. Katakura); Kayu Jao, 1♂, Feb. 3, 1989 (S. Nakano); Lake Talang, 1♂, June 9, 1989 (S. Nakano), 1♂1♀, July 22, 1989 (S. Nakano & Asril), 2♂♂, May 14, 1989 (Asril). Java: Cibodas, 4♂♂3♀♀, Oct. 31, 1990 (H. Katakura *et al.*), 3♀♀, Nov. 1, 1990 (H. Katakura *et al.*); Mt. Gede, 1♂, Jan. 29, 1991 (S. Kahono); Puncak Pass, 2♀♀, Oct. 31, 1990 (Sih Kahono); Mt. Salak, 2♂♂2♀♀, Oct. 26, 1991 (H. Katakura & S. Kahono).

Remarks. Like *E. vigintioctopunctata*, this species is a pest of solanaceous crops and weeds (Table 1). The distribution is restricted to cooler highlands higher than approximately 400 m above the sea level (Katakura *et al.*, 1988), where it occurs together with *E. vigintioctopunctata*. Some specimens have been collected from *Brugmansia candida* growing along the mountain path in Mt. Gede. In this respect, the present species is somewhat different ecologically from *E. vigintioctopunctata* that occurs only on the plants in rural areas.

Species with toothless tarsal claws and the sixth visible abdominal sternite of the female being not split (= *"Epilachna"*)

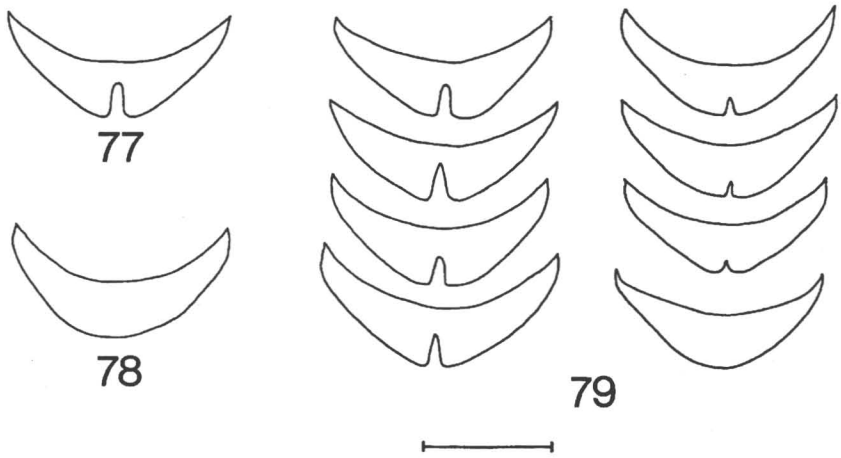
***Epilachna alternans* Mulsant** (Figs. 16-19, 47, 69, 77, 79)

Maculation (Figs. 16-19). Head and pronotum spotless. Scutellum light. Elytron with 6 spots. Spots 1 and 5 usually reaching suture. Size of the spots variable individually and locally. Spot 1 and 2 often fused, forming a basal fascia. Spots 3 and 4 often, and 3-4-5 rarely fused.

Genitalia. Male, Fig. 47; female, Fig. 69.

Size. Male (N = 13), 6.1-7.9 mm; female (N = 12), 6.1-8.7 mm.

Material examined. Sumatra: Mt. Tandikat, 5♂♂1♀, Sept. 20, 1987 (I. Abbas); Mt. Kerinci, 2♂♂3♀♀, Jan. 16-17, 1986 (I. Abbas), 19♂♂14♀♀, July 15, 1986 (I. Abbas), 2♀♀, Nov. 15, 1993 (T. Sota); Mt. Rasam, 4♂♂2♀♀, July 19, 1989 (Asril & S. Nakano), 16♂♂2♀♀, March 19, 1989 (Asril, S. Nakano & Zaldi), 1♀, Feb. 26, 1989 (Zaldi), 1♂3♀♀, Nov. 15, 1990 (Asril & H. Katakura), 1♂1♀(Asril), 1♂ (S. Nakano), Feb. 6, 1994, 1♂, Aug. 31, 1997 (S. Nakano); Lake Talang, 1♀, June 2, 1989 (Asril), 2♀♀, June 9, 1989 (Asril), 1♂1♀, May 14, 1989 (Asril), 1♂2♀♀,



Figs. 77-79. Sixth visible abdominal sternite of female. 77; 78, *E. alternans* and *E.* sp. I from Mt. Rasam, West Sumatra; 79, variation in *E. alternans* from Mt. Gede, West Java.

Oct. 31, 1993 (H. Katakura *et al.*); Kayu Jao, 1♀, Sept. 25, 1988 (S. Nakano), 1♂, Dec. 9, 1988 (S. Nakano), 1♂1♀, Dec. 18, 1988 (Zaldi), 1♂, Feb. 3, 1989 (S. Nakano), 2♂♂1♀, Feb. 3, 1989 (S. Nakano); Kayu Aro, 1♀, Nov. 8, 1990 (H. Katakura); Padang Panjang, 1♀, Jan. 15, 1989 (Zaldi); Air Sirah, 1♀, Jan. 4, 1981 (K. Nakamura), 1♂1♀, Jan. 16, 1981 (K. Nakamura), 1♀, Dec. 2, 1980 (K. Nakamura), 2♀♀, Nov. 16, 1988 (S. Nakano), 1♀, Nov. 22, 1988 (S. Nakano), 1♀, Nov. 13, 1990 (H. Katakura), 1♂1♀, Nov. 8, 1990 (Asril & H. Katakura), 1♀, Oct. 31, 1993 (H. Katakura), 1♀, Jan. 20, 1994 (Asril); Lubuk Selasih-Kayu Jao, 1♂1♀, Oct. 12, 1988 (S. Nakano); Sukarami, 1♂1♀, Jan. 27, 1994 (S. Nakano), 1♂, Aug. 24, 1997 (S. Nakano), 1♂, Aug. 18, 1998 (S. Nakano). Java: Cibodas, 1♀, Nov. 1, 1990 (S. Kahono); Mt. Gede, 1♂5♀♀, Nov. 28-29, 1990 (H. Katakura & S. Kahono), 3♂♂3♀♀, Jan. 29, 1991 (S. Kahono), 1♂1♀ Nov. 9, 1996 (S. Kahono); Halimun, Malasari, 1000 m, 2♀♀, May 9, 1996 (S. Kahono); Mt. Salak, 2♂♂2♀♀, Oct. 26, 1993 (H. Katakura & S. Kahono), 2♀♀, Nov. 18, 1994 (H. Katakura & S. Kahono), 1♂1♀, Sept. 1, 1996 (S. Nakano), 1♀, Sept. 18, 1996 (S. Kahono), 1♂, Nov. 1, 1996 (S. Nakano); Karanganyar, Tawangmangu, Cemorokandang 1765m, 1♂2♀♀, Apr. 22, 1998 (S. Kahono); Magetan, Cemorosewu, 1795 m, 1♂3♀♀, Apr. 22, 1998 (S. Kahono); Cangar, Batu, 1♂, Jan. 4, 1994 (S. Nakano); Wonokiri, Bromo 2540-2550 m, 2♀♀, Sept. 2, 1995 (S. Nakano); Air Panas Cangar, 1450 m, Oct. 29, 1994, 1♀ (H. Katakura), 1♂1♀ (S. Kahono).

Remarks. Application of the name *E. alternans* to the above listed specimens is provisional. They were collected at various localities in Sumatra and Java, feeding exclusively on cucurbits (Table 1). They are morphologically very similar to *E. alternans* or *E. grayi* Mulsant, but are variable in body size, pattern of elytral maculation, and some genitalic characters. Specimens from Sumatra and West Java and those from Central and East Java are different in their external appearance. The latter are considerably larger and elongate than the former, and their elytral pattern is very characteristic, spots 1-2, and 4-3-5 respectively coalescing to form fasciae with their counterparts (Fig. 19). In this regard, the specimens from Central and East Java well agree with *E. alternans* figured by Bielawski (1961). However, there are many problems to be resolved before we determine the taxonomic position of the

present material.

First, male genitalia of the present specimens are somewhat different from those so far reported for *E. grayi* in Continental Asia (Kapur, 1955; Pang & Mao, 1979), and for *E. alternans* from Java (Bielawski, 1961) in that the sipho has a small hook on the inner wall (Fig. 47; the position of the hook is variable according to the localities where the specimens were collected). In this point, our *E. alternans* is similar to *Epilachna glochinosa* Pang et Mao, 1979, and *E. hopeiana* Miyatake, 1985.

Second, two types of visible abdominal sternite VI of females are found in the present material, one with a distinct median notch (Fig. 77) and the other without it. The notched specimens well agree with *E. alternans* originally described from Java, and the notchless specimens with *E. grayi* previously recorded from Java (Booth & Pope, 1989). Dieke (1947) erroneously interpreted that *E. grayi* has a notched sternite, and *E. alternans* has a notchless one. Miyatake also followed this interpretation when he examined Nepalese epilachnines (Miyatake, 1985). The sixth sternite of the female of Miyatake's *E. grayi* has thus a median notch whereas the female of *E. hopeiana* does not have any notch. No female specimen has been known of *E. glochinosa*.

In the present study, specimens from a single locality usually showed either notched or notchless condition. However, both notched and notchless specimens were collected from Mt. Kerinci in West Sumatra. Furthermore, specimens collected at Mt. Gede, West Java not only contained both notched and notchless specimens, but also involved individuals that showed various intermediate conditions (Fig. 79).

A careful reevaluation of the conditions of male genitalia and the sixth abdominal sternite of females is necessary to clarify the taxonomic status of the Indonesian forms here referred to as *E. alternans*.

***Epilachna* sp. I** (Figs. 21, 48, 78)

Maculation (Fig. 21). Head and pronotum spotless. Scutellum light. Elytron with 6 spots. Right and left spots 1 and 5 respectively fused on suture, 4 reaching margin, 3-4 (and rarely 3-4-5) fused.

Genitalia. Male, Fig. 48; female, as in *E. alternans* (Fig. 69).

Size. Male (N = 4), 6.8-8.2 mm; female (N = 3), 7.5-7.8 mm.

Material examined. Sumatra: Mt. Rasam, 3♂♂2♀♀, July 19, 1989 (Asril); 1♂1♀, Nov. 15, 1990 (Asril & H. Katakura).

Remarks. This species, collected on an unidentified herbaceous vine (Compositae) at Mt. Rasam, Sumatra, is closely similar to *E. alternans* above. However, the present species is easily discernible from sympatric *E. alternans*, which was collected on a cucurbit, *Gynostemma*, by the slight but distinct difference in the structure of the apex of sipho in males and sixth visible abdominal sternite of females being not notched (Fig. 78; in *E. alternans* in Mt. Rasam the sixth abdominal sternite of the female is always notched [Fig. 77]).

***Epilachna* sp. L** (Fig. 20)

Maculation (Fig. 20). Similar to *E. alternans*. Head and pronotum spotless. Scutellum light. Elytron with 6 spots. Right and left spots 1 and 5 respectively fused on suture. Spot 4 reaching margin, spot 6 nearly so.

Genitalia. Male, unknown; female, as in *E. alternans* (Fig. 69).

Size. Female (N = 1), 9.4 mm.

Material examined. Sumatra: Mt. Rasam, 1♀, Aug. 31, 1997 (S. Nakano).

Remarks. Only one female specimen is available to us. This specimen is very similar to sympatric populations of *E. alternans* and *E.* sp. I in spot pattern and female genitalia. However, the size was considerably larger than the latter two species. The sixth abdominal sternite was entire as in *E.* sp. I. Host plants are unknown. Under laboratory conditions this individual did not eat leaves of squash, *Boehmeria*, *Clematis*, and the host plant of *E.* sp. I (an unidentified Compositae). These facts suggest that the present specimen represents a distinct species rather than an exceptionally large individual of *E.* sp. I or *E. alternans*.

***Epilachna* sp. F** (Figs. 22, 49)

Maculation (Fig. 22). Head and pronotum spotless. Scutellum light. Elytron with a basal transverse fascia (spot nos. 1+2) and 4 spots. Basal fascia touching base, suture and margin. Spots 3 and 4 fused and touching margin. Right and left spot 5 fused on suture, being faintly connected with spot 3. Spots 3-5-3 arranged in V.

Genitalia. Male, Fig. 42; female, as in *E. alternans* (Fig. 69).

Size. Male (N = 2), 5.7-5.9 mm; female (N = 3), 5.7-6.4 mm.

Material examined. Java: Mt. Gede, 1♂1♀, Nov. 28, 1990 (H. Katakura & S. Kahono), 1♂1♀, Sept. 6, 1997 (S. Nakano); Cibulnunggul, Kalapanunggal, 1♂1♀, Nov. 4, 1994 (H. Katakura).

Remarks. This cucurbit feeding species has so far been known only in West Java. The pattern of elytral maculation in the present species is very similar to that of sympatric *E.* sp. 5 (Fig. 12) and *E. gedeensis* (Figs. 32, 33), though the present species is larger than the latter two species.

***Epilachna decipiens* Crotch** (Figs. 23, 24, 50, 70)

Maculation (Figs. 23, 24). Head spotless. Pronotum with a large spot medially. Scutellum light. Elytron with 6 spots. Spots 1 and 5 reaching suture, 4 reaching margin. Some specimens had spots 1 and 2 being fused to form a basal fascia, which did not reach base and margin. Likewise, spots 5-3-4 sometimes fused to form a medial fascia running from margin to margin; in such a case constriction between spots prominent.

Genitalia. Male, Fig. 50; female, Fig. 70.

Size. Male (N = 2), 7.6-8.0 mm; female (N = 4), 8.3-8.7 mm.

Material examined. Java: Cibodas, 1♂1♀, Oct. 31-Nov. 1, 1990 (H. Katakura), 1♂1♀, Nov. 5, 1993 (H. Katakura & S. Kahono), 2♀♀, Nov. 5, 1994 (H. Katakura & S. Kahono).

Remarks.This species has been collected on *Clematis lechenaultiana* at Mt. Gede. The morphology of the present species well agrees with the redescription of *E. decipiens* by Bielawski (1961) except that the present specimens have cavities on elytral epipleura for the reception of the middle and hind femora. The present species is closely similar to *E. magna* (Dieke) from Fukien, China, in the male genitalic structure (Dieke, 1947; Pang & Mao, 1979) but the elytral pattern is different.

***Epilachna* sp. M** (Figs. 25, 71)

Maculation (Fig. 25). Head spotless. Pronotum with a faint dark spot medially. Scutellum light. Elytron with 6 spots. Spot 1 very close to suture. Spot 4 reaching margin.

Genitalia. Male, unknown; female, Fig. 71.

Size. Female (N = 1), 7.8 mm.

Material examined. Sumatra: Mt. Rasam, 1♀, Feb. 6, 1994 (S. Nakano).

Remarks. Only one female specimen is available to us. Food plant is unknown. This species is very similar to *E. decipiens* in the morphology of female genitalia and the fact that both have cavities on the elytral epipleura for the reception of the tips of the middle and hind femora. The two species differ in the shape of tergite X, however.

***Epilachna* sp. G** (Figs. 26, 51, 72)

Maculation (Fig. 26). Head spotless. Pronotum without or with a faint black spot medially. Scutellum light. Elytron with two transverse fasciae and an apical spot. Basal fascia (spots 1-2) not reaching the base, margin, or suture. Medial fascia (spots 5-3-4) touches margins, and may or may not be united on suture. Spot 6 elongate. In one female specimen, spots 3 and 5 separate, and spot 4 missing.

Genitalia. Male, Fig. 51; female, Fig. 72.

Size. Male (N = 5), 6.2-6.7 mm; female (N = 6), 6.9-7.5 mm.

Material examined. Java: Mt. Gede, 1♂1♀, Nov. 28, 1990 (H. Katakura), 1♂1♀, Oct. 29-31, 1991 (H. Katakura), 2♂♂2♀♀, Nov. 5, 1993 (H. Katakura & S. Kahono), 1♀, Nov. 5, 1994 (H. Katakura & S. Kahono).

Remarks. This species has also been collected on *Clematis lechenaultiana* at Mt. Gede. It is separable from *E. decipiens* on the same food plant by the elytral pattern, body size and details of male and female genitalia. Furthermore, this species does not have cavities on the elytral epipleura for the reception of middle and hind femora. The present species is similar to *Epilachna dorotae* described from Bhutan (Bielawski, 1979) in the structure of male genitalia, but the two species are quite different in elytral patterns. Externally the present species is very similar to sympatric *E. bifasciata* (Fig. 5) and *E. orthofasciata* (Fig. 27), in particular the former, nevertheless they are distantly related taxonomically.

***Epilachna orthofasciata* (Dieke)** (Figs. 27, 52, 73)

Maculation (Figs. 27). Head and pronotum spotless. Scutellum light. Elytron with two transverse fasciae and one apical spot (No. 5). Basal fascia not reaching base or margins; not or weakly fused on suture. Second (medial) fascia reaching lateral margin, separated by or fused on the suture.

Genitalia. Male, Fig. 52; female, Fig. 73.

Size. Male (N = 3), 5.4-6.2 mm; female (N = 6), 5.7-6.6 mm.

Material examined. Java: Mt. Gede, 1♂, Nov. 28-29, 1990 (H. Katakura), 1♀, Oct. 29, 1991 (H. Katakura), 2♀♀, May 21, 1992 (S. Kahono), 1♂3♀♀, Nov. 5, 1993 (H. Katakura & S. Kahono), 1♂ 1♀, Nov. 5, 1994 (H. Katakura & S. Kahono).

Remarks. Adults and larvae have been collected on *Tetrastigma papilosum* (Vitacea) in Mt. Gede, West Java, the type locality of this species. All the specimens from Mt. Gede have two fasciae and a pair of apical spots on elytra, and are very similar to sympatric *E. bifasciata* (Fig. 5) and *E.* sp. G (Fig. 26). This species was first described as *Afissa orthofasciata* by Dieke (1947) and later the male genitalia were described by Bielawski (1960). Katakura *et al.* (1994) referred to this species under the name

Epilachna orthofasciata. Their action yielded a *comb. nov.*, although they did not specifically noticed it.

Some specimens (all females), which are similar to *E. orthofasciata* in genitalia, have been collected at Mt. Salak, West Java as follows: Mt. Salak, 2♀♀, Aug. 13, 1995 (S. Nakano), 1♀, Sept. 18, 1996 (S. Kahono), 1♀, Nov. 12, 1996 (N. Fujiyama & T. Koizumi). In three out of the four specimens, all the five elytral spots are separate, but spots 1 and 2 of the remaining specimen are united as in *E. orthofasciata*. Another female specimen collected in Situ Gunung, Bogor (Aug. 29, 1995 by S. Nakano) has separate spots 1 and 2, but with united spots 3 and 4. These specimens are probably either *E. orthofasciata* or *E.* sp. K mentioned later.

A form similar to *E. orthofasciata* is rather common in West Sumatra. It is also placed here.

Sumatra: Mt. Merapi, 1♂, Dec. 22, 1980 (K. Nakamura & I. Abbas); Mt. Kerinci, 1♂1♀, July 15, 1986 (I. Abbas); Kayu Jao, 1♀, Sept. 25, 1988 (Asril); Mt. Rasam, 1♀, July 19, 1989 (S. Nakano), 1♂, July 19, 1989 (Asril), 1♂3♀♀, March 19, 1989 (S. Nakano & Asril), 1♀, March 19, 1989 (Zaldi), 2♂♂, Aug. 27, 1998 (S. Nakano); near L. Talang, 3♂♂1♀, Oct. 31, 1993 (H. Katakura *et al.*), 4♂♂4♀♀, Feb. 5, 1994 (S. Nakano & Asril); Sukarami, 3♂♂, Nov. 18, 1993 (T. Sota), 1♂, Jan. 27, 1994 (S. Nakano), 1♂, Nov. 12, 1994 (H. Katakura), 3♂♂2♀♀, Nov. 15, 1996 (H. Katakura *et al.*); Pinang Pinang, 1♂2♀♀, Aug. 22, 1998 (S. Nakano; collected as larvae, reared to adults in laboratory).

Size: Male (N = 4), 5.3-6-7 mm; female (N = 7), 5.7-6.6 mm.

The Sumatran specimens have been obtained from Vitaceae and Actinidiaceae. In the Sumatran specimens, spots 1 and 2 form a basal fascia (Fig. 28) or the two spots are separate; spots 3 and 4 are always separate; one specimen lacking spot 3. The specimens with five separate spots on each elytron are very similar to *E.* sp. K mentioned below though the former is larger than the latter. Although identified here with *E. orthofasciata*, the Sumatran form may be a different species, or involves more than one species.

***Epilachna* sp. K** (Figs. 29, 53)

Maculation (Fig. 29) Head and pronotum spotless. Scutellum light. Elytron with 5 spots, arranged in 2, 2, 1. All spots free from base, suture and margin.

Genitalia. Male, Fig. 53; female, similar to *E. orthofasciata* (Fig. 73).

Size. Male (N = 5), 5.5-5.9 mm; female (N = 6), 5.5-5.9 mm.

Material examined. Java: Kebun Raya Bogor, 1♀, Nov. 12, 1990 (H. Katakura), 5♂♂5♀♀, Nov. 17-25, 1990 (H. Katakura), 1♂, May 9, 1998 (S. Kahono).

Remarks. Adults and immatures have been confirmed on a vine, *Cissus modesta*, in the Bogor Botanic Gardens (Kebun Raya Bogor). In both male and female genitalia and elytral spot pattern, the present species is most similar to *E. hendecaspilota* (Mader) so far recorded from various localities of South and Southeast Asia (Bielawski, 1964, 1980; Pang & Mao, 1979; Hoàng, 1983). The present species is also very similar to *E. orthofasciata* in male and female genitalia, but is separable from the latter by the smaller body size and pattern of elytral maculation. The present species is closely similar to *E.* sp. B in the pattern of elytral maculation. For the discrimination of these two species, see "Remarks" of *E.* sp. B.

***Epilachna* sp. B** (Figs. 30, 54)

Maculation (Fig. 30). Head spotless. Pronotum with one spot medially. Scutellum light. Elytron

with 5 spots. All the spots free from base, suture and margin.

Genitalia. Male, similar to those of *E. orthofasciata* and *E.* sp. K mentioned above, but the curvature of the tip of sipho is most acute in the present species (Fig. 54). Female, similar to *E. orthofasciata* (Fig. 73).

Size. Male (N = 6), 5.6-6.1 mm; female (N = 6), 5.8-6.4 mm.

Material examined. Sumatra: Kayu Jao, 1♂, Nov. 8, 1990 (K. Matsumoto); near Lake Talang, 4♂♂3♀♀, June 9, 1989 (Asril), 1♂1♀, July 22, 1989 (S. Nakano & Asril), 2♀♀, June 2, 1989 (Asril).

Remarks. This species was collected on a vine, *Cayratis* sp., in Sumatra. It is most similar to *E. galerucinoides* Korschefsky in the condition of the tip of sipho, which was figured by Bielawski (1959) for the specimens collected on Flores Island. But the elytral pattern is different from that of *E. galerucinoides* that has characteristic two spots on each elytron (probably spots 1+2 and 4+5, and spot 3 lacking; Korschefsky, 1934; Bielawski, 1959). On the other hand, Pang and Mao (1979) and Hoàng (1983) recorded ten-spotted forms (five spots on each elytron) of *E. galerucinoides* from China and Vietnam, respectively. If their interpretation is correct, the present species is likely *E. galerucinoides*. Externally the present species is similar to *Epilachna* sp. K above, from which it can be separated by the larger body, a spot on pronotum, deeper elytral color, and more conspicuous curvature of the tip of sipho.

***Epilachna* sp. J** (Fig. 31)

Maculation (Fig. 31). Head and pronotum spotless. Scutellum light. Basal half of elytra including base, margin and suture black, rest reddish brown except for a pair of black apical spots.

Genitalia. Male, unknown; female, similar to *E. orthofasciata* (Fig. 61).

Size. Female (N = 1), 7.4 mm.

Material examined. Sumatra: Mt. Kerinci, 1♀, July 15, 1986 (I. Abbas)

Remarks. One female with a unique elytral pattern was collected at Mt. Kerinci. Female genitalia are similar to those of *E. orthofasciata*. Food plant is unknown.

***Epilachna gedeensis* Dieke** (Figs. 32, 33, 55, 74)

Maculation (Figs. 32, 33). Head and pronotum spotless. Scutellum light. Elytra with a basal fascia (spots 1, 2), a medial fascia (4+3+5) and a pair of apical spots (no. 6). Basal fascia reaching base and suture. Medial fascia reaching margin. Spot 5 may be separate from spot 3. Spot 3-5-3 arranged in V.

Genitalia. Male, Fig. 55; female, Fig. 74.

Size. Male (N = 3), 4.5-4.7 mm; female (N = 3), 4.3-4.7 mm.

Material examined. Java: Mt. Gede, 3♂♂3♀♀, Nov. 28-29, 1990 (H. Katakura *et al.*).

Remarks. The present species is common on a herb, *Elatostema acuminata*, growing along a pass of Mt. Gede. It has been rarely collected on *Elatostema strigosum* also growing there. Elytral pattern of the present species resembles those of sympatric *E.* sp. 5 (Fig. 12) and *E.* sp. F (Fig. 22).

A form quite similar to *E. gedeensis* has been collected at Cangar, East Java on some species of Urticaceae: Cangar, 1♂, Jan. 4, 1994 (S. Nakano); Air Panas Cangar, 4♂♂5♀♀, Oct. 29, 1994 (S. Kahono & A. Suprapto). These specimens are similar to *E. gedeensis* in body size, genitalia of both sexes and general external appearance. However, the elytral pubescence appears more whitish, and each elytron seems to have *five* spots instead of six. This form may represent yet another species

closely related to *E. gedeensis.*

***Epilachna incauta* Mulsant** (Figs. 34, 56)

Maculation (Fig. 34). Head and pronotum spotless. Scutellum light. Elytron with 5 spots. Spot 1 on suture, spot 3 reaching suture.

Genitalia. Male, Fig. 56; female, similar to *E. gedeensis* (Fig. 74).

Size. Male (N = 7), 5.0-5.5 mm; female (N = 6), 5.3-5.7 mm.

Material examined. Sumatra: Air Sirah, 1♂, Nov. 16, 1988 (S. Nakano), 4♂♂3♀♀, Nov. 8, 1988 (S. Nakano), 4♂♂, Sept. 5, 1988 (S. Nakano), 2♂♂2♀♀, Feb. 3, 1989 (S. Nakano), 1♂1♀, Nov. 8, 1990 (Asril); Kayu Jao, 2♂♂2♀♀, Feb. 3, 1989 (S. Nakano & Asril); Sukarami, 1♂1♀, Nov. 18, 1993 (T. Sota); Mt. Rasam, 1♀, Aug. 27, 1998 (S. Nakano). Java: Mt. Salak, 4♂♂2♀♀, Oct. 26, 1991 (H. Katakura & S. Kahono); Karanganyar, Tawangmangu 1020 m, 1♀, 1750 m, 1♀, Apr. 21, 1998 (S. Kahono).

Remarks. This species has been collected on several plant species belonging to Urticaceae in West Sumatra and West and Central Java. Immature stages have been also confirmed on these plants.

Species with toothed tarsal claws and the sixth visible abdominal sternite of the female being not split

***Afidenta misera* (Weise)** (Figs. 15, 57, 76)

Maculation (Fig. 15). Head spotless. Pronotum with two small spots. Scutellum light. Elytron with 6 spots. All spots free from base, suture and margin.

Genitalia. Male, Fig. 57; female, Fig. 76.

Size. Male (N = 6), 5.1-5.6mm; female (N = 2), 5.1-5.8 mm.

Material examined. Java: Cibinong, 3♂♂1♀, March 3, 1987 (K. Nakamura); Bogor Botanic Gardens, 1♂1♀, Sept. 5, 1995 (S. Nakano); Prambanan, candi Boko, 100 m, 2♂♂, May 11, 1998 (S. Kahono).

Remarks: This species has been known as a pest of soybeans in Southeast Asia.

***Epilachna* sp. C** (Figs. 35, 75)

Maculation (Fig. 35). Head spotless. Pronotum with a spot medially. Scutellum light. Elytron with 5 spots. All spots free from suture, base or margin.

Genitalia. Male, unknown; female, Fig. 75.

Size. Female (N = 1), 6.1 mm.

Material examined. Sumatra: Kayu Jao, 1♀, Feb. 3, 1989 (Asril).

Remarks. Only one female collected on *Linociera* sp. (Oleaceae) is available. In this specimen, the tarsal claw is bifid, with a weakly developed basal tooth. The sixth abdominal sternite is narrow and entire. In these points, the present specimen may be assigned to *Afidenta, Afissula* Kapur, or *Afidentula* Kapur. However, the genital plates (Fig. 75) are very unique, and do not fit to any types of genital plates known for the above mentioned genera. The generic position of this species is left undetermined, although it is tentatively placed here in *Epilachna* (*sens. lat.*).

MISCELLANEOUS NOTES

Tentative grouping of the Indonesian epilachnines. As enumerated above, a total of 26 species are treated in the present study. They include eleven species of *"Henosepilachna"*, thirteen species of *"Epilachna"*, one species of *Afidenta,* and one species (*E.* sp. C) whose generic position is enigmatic. The species of *"Epilachna"* can be further divided into the following four groups on the basis of male and/or female genitalia.

Group 1: *E. alternans*, *E.* sp. I, *E.* sp. L and *E.* sp. F. Members of this group constitute a part of the *E. admirabilis* group defined by Dieke (1947). In all the species, female genitalia are of the same type. Tergite X is emarginate and genital plates are ovaloid and pointed at the base. The median lobe of the male genitalia is a simple tube moderately curved and ending in a single point. The sipho is long, slender and curved.

Group 2: *E. decipiens*, *E.* sp. M and *E.* sp. G. This group is characterized by the tergite X of the female having its apical part folded back. Dieke (1947) classified this group into the *szechuana* group and the *chapini* group. *E. decipiens* and *E.* sp. M are assigned to the *chapini* group because of the possession of distinct cavities on the elytral epipleura for the reception of the middle and hind femora, whereas *E.* sp. G to the *szechuana* group by the lack of such cavities on epipleura. We once incorrectly placed *E.* sp. G in the *E. chapini* group together with *E. decipiens* (Katakura *et al.*, 1994a).

Group 3: *E. orthofasciata*, *E.* sp. K, *E.* sp. B and *E.* sp. J. These four species belong to the *flavicollis* group of Dieke (1947). This group is characterized by the female genitalia with the genital plates very elongate and tergite X with a very convex but simple hind margin (*E.* sp. J is tentatively placed here by the shape of female genitalia). They also share a characteristic shape of male genitalia, in particular the sipho that bents near the apex. As already shown, three species of this group (*E. orthofasciata*, *E.* sp. K, *E.* sp. B) are very closely similar to each other. Furthermore, there are some forms whose identity is still not clear (see, Remarks of *E. orthofasciata*). A thorough understanding of their relationships needs careful and intensive studies with sufficient amount of specimens from diverse localities.

Group 4: *E. gedeensis* and *E. incauta*. The two species shared very similar conditions in genitalia of both sexes: female genitalia with elongate (but no so as in Group 3) genital plates, and male genitalia with the long sipho ending with a simple apex. Dieke (1947) placed *E. gedeensis* in his *fallax* group and *E. incauta* in the *flavicollis* group based on the difference in the number of elytral spots (*gedeensis*, six per elytron; *incauta*, five). However, the discovery of the five spotted (per elytron) form of *E. gedeensis* or its close relative in East Java (see, Remarks of *E. gedeensis*) indicates that the number of spots is not a reliable character for the separation of species groups. Furthermore, Dieke's *fallax* group was an assemblage of species with various types of male and female genitalia as Dieke himself mentioned. We therefore lump *E. gedeensis* and *E. incauta* in a distinct species group, although we once placed them in the *fallax* group (Katakura *et al.*, 1994a).

Faunal composition. Table 2 summarizes taxonomic groups, localities, habitats, and food plants (families) of epilachnine beetles treated in the present paper. Out of the 26 species collected, ten species are common to Sumatra and Java, 9 only from Sumatra, and 7 only from Java (a total of 19 species for Sumatra and 17 species for Java). However, it is difficult to draw any general conclusion

Table 2. A list of epilachnine ladybird beetles collected in Sumatra and Java.

	Species	Taxonomic group [1]	Locality		Habitat [2]			Food Plant
			Sumatra	Java	R	R/N	N	
1	*E. vigintioctpunctata*	H	+	+	+			Solanaceae
			+	+	+			Leguminosae
2	*E. pusillanima*	H	+	+	+	+		Cucurbitaceae
3	*E. septima*	H	+	+	+			Cucurbitaceae
4	*E. bifasciata*	H		+			+	Solanaceae
5	*E. sumatrensis*	H	+				+	Solanaceae
6	*E.* sp. 3	H	+	+	+			Compositae
				+	+			Labiatae
7	*E. pytho*	H	+	+		+	+	Cucurbitaceae
8	*E. boisduvali*	H	+		+			Cucurbitaceae
9	*E.* sp. 4	H	+				+	Cucurbitaceae
10	*E.* sp. 5	H	+	+			+	Acanthaceae
11	*E. enneasticta*	H	+	+	+	+		Solanaceae
12	*E. alternans*	E(1)	+	+		+	+	Cucurbitaceae
13	*E.* sp. I	E(1)	+				+	Compositae
14	*E.* sp. L	E(1)	+				+	(Unknown)
15	*E.* sp. F	E(1)		+			+	Cucurbitaceae
16	*E. decipiens*	E(2)		+			+	Ranunculaceae
17	*E.* sp. M	E(2)	+				+	(Unknown)
18	*E.* sp. G	E(2)		+			+	Ranunculaceae
19	*E. orthofasciata*	E(3)	+	+			+	Vitaceae
			+					Actinidiaceae
20	*E.* sp. K	E(3)		+		+		Vitaceae
21	*E.* sp. B	E(3)	+				+	Vitaceae
22	*E.* sp. J	E(3)	+				+	(Unknown)
23	*E. gedeensis*	E(4)		+			+	Urticaceae
24	*E. incauta*	E(4)	+	+			+	Urticaceae
25	*A. misera*	AF		+	+			Leguminosae
26	*E.* sp. C	U	+				+	Oleaceae

[1] H, "*Henosepilachna*"; E(1) - E(4), species groups 1 to 4 of "*Epilachna*" defined in the text; AF, *Afidenta*; U, generic position undetermined.
[2] R, rural; R/N, semirural (seminatural); N, natural.

about the epilachnine fauna of Sumatra or Java, because our survey covered only very small parts of these large islands. The number of species will undoubtedly increase with the expansion of survey to cover wider geographic areas with diverse vegetation types.

Food plant: As shown in Table 1, most species were host specific, at least at the family level of food plants (Table 2). Exceptions are *E. vigintioctopunctata* that feeds on *Centrosema* (Leguminosae) in addition to various solanaceous plants, *E.* sp. 3 collected on *Mikania* (Compositae) and some species of Labiatae, and Sumatran *E. orthofasciata* collected on Vitaceae and Actinidiaceae (Table 2). Nishida *et al.* (1997) suggested that *E. vigintioctopunctata* might be in the process of the formation of a new host race (the *Centrosema* feeding race) from the solanum feeding race. Preliminary studies further suggested a possible sympatric divergence of *E.* sp. 3 and Sumatran *E. orthofasciata* along different food plant lines (S. Nakano, unpublished). These Indonesian epilachnines seem to be a promising material to test one of the most controversial issues of speciation, the sympatric origin of novel species in phytophagous insects (Howard & Berlocher, eds., 1998).

Geographic variation of food plant use is also suggested for *E. vigintioctopunctata* and *E.* sp. 3. *Epilachna vigintioctopunctata* seemed to decrease its utilization of *Centrosema pubescens* in Central and East Java. Likewise, *E.* sp. 3 occurred mainly on *Mikania* in West Java, but it was not collected on this plant in Central and East Java, where it occurred on some Labiatae species (Table 1). Since there is an eastward increase of aridity in Java, these results might be caused by differential climatic conditions of the habitats.

Furthermore, certain relationships are evident between taxonomic groups of Indonesian epilachnines and their food plants. Food plants of *"Henosepilachna"* species were concentrated to two plant families, Solanaceae and Cucurbitaceae. On the other hand, food plants of *"Epilachna"* species were distributed in six diverse plant families, but members of the same taxonomic group tended to utilize plants of the same family as their food plants as follows (numerals in parentheses indicate number of species feeding on the plant family and the total number of species of each epilachnine group for which food plants are known): Group 1, Cucurbitaceae (2/3); Group 2, Ranunculaceae (*Clematis*) (2/2); Group 3, Vitaceae (3/3); and Group 4, Urticaceae (2/2).

Habitat and abundance: *"Henosepilachna"* included the species occurring in rural areas and those in undisturbed habitats, whereas *"Epilachna"* lacked species living exclusively in disturbed habitats. *Afidenta misera* was also a dweller of disturbed habitats. In other words, only *"Henosepilachna"* and *Afidenta* yielded pest species. This may be partly explained by the fact that many *"Henosepilachna"* species occur on the two plant families, Solanaceae and Cucurbitaceae, both of which include numerous important crops and weeds. However, this does not explain why some *"Henosepilachna"* and *"Epilachna"* species that feed on solanaceous or cucurbitaceous plants do not become pests.

Except for the pest species and species occurring on weeds, the density of Indonesian epilachnine beetles was generally low, and in some species, only one or a few adult individuals have been collected in spite of intensive effort for collecting. Furthermore, immatures of these low-density species seemed much rarer than the adults. This suggests a low fecundity or high immature mortality of these species, as well as long adult longevity relative to the immature period. But biology of these low-density species is yet only fragmentarily known (cf. Nakano *et al*, 2001, for possible relevance of oviposition patterns to the beetle abundance).

Convergence of elytral pattern in sympatric epilachnines: As pointed out by Dieke (1947), many Asian species of epilachnines have a strikingly similar external appearance with many black spots on the brownish background of dorsum. It was true for Indonesian species treated in the present study (Figs. 1-35). Furthermore, in the course of this study we have noticed that sympatric epilachnine species with similar body size are often strikingly similar in external appearance even if they are taxonomically distantly related. Below we will examine three such cases:

Case 1. *E. bifasciata* (Fig. 5)-*E.* sp. G (Fig. 26)-*E. orthofasciata* (Fig. 27) (Mt. Gede): The three species are approximately of equal size and are characterized by elytra with two transverse fasciae and a pair of apical spots. Although the ground color of elytra is reddish in *E. orthofasciata* whereas somewhat brownish in the other two species, their elytral patterns are so similar that one might easily confuse them. However, species groups and food plants of the three species are distinctly different: *E.*

bifasciata-*"Henosepilachna"*, Solanaceae; *E. orthofasciata*-Group 3, Vitaceae; *E.* sp. G-Group 2, Ranunculaceae. In *E. orthofasciata* specimens collected in Sumatra, where neither *E. bifasciata* nor *E.* sp. G occurred, elytral spots 3 and 4 were separate and did not form a fascia, and so they are easily discernible from the latter two species.

Case 2. *E.* sp. 5 (Fig. 12)-*E. gedeensis* (Fig. 32)-*E.* sp. F (Fig. 22) (Mt. Gede): *Epilachna* sp. 5 and *E. gedeensis* are of equal size; sp. F a little larger. This series is characterized by the position of spots 3 and 5 arranged in "V". In this case, too, species groups and food plants differ as: *E.* sp. 5-*"Henosepilachna"*, Acanthaceae; *E. gedeensis*-Group 4, Urticaceae; *E.* sp. F-Group 1, Cucurbitaceae.

Case 3. *E. pytho* (Fig. 8)-*E. alternans* (Fig. 17) (Padang): In this pair, both species have six spots on each elytron; spots 1 and 5 on the elytral suture, forming with respective counterparts large discal spots. *E. alternans*, which was collected from diverse localities in Sumatra and Java, showed a considerable degree of individual variation in elytral pattern and body size. Likewise, *E. pytho* from Java and those from Sumatra were different in size and elytral pattern. Nevertheless, in several localities near Padang, West Sumatra, where the two species occurred sympatrically and were often found on the same plants of *Sechium edule*, they were very similar in size and elytral pattern. Unlike the above two cases, the two species occurred on the same kind of food plants (Cucurbitaceae) but the species groups are again different: *E. pytho*-*"Henosepilachna"*; *E.* sp. H-Group 1.

Three interpretations are possible for this striking phenotypic similarity: 1) Sharing of ancestral characters, 2) sharing of derived characters, and 3) homoplasy (the sharing of a character derived through convergence, parallelism, or reversal).

In all three cases mentioned above, the species involved are apparently distantly related. Therefore, the second interpretation is difficult to apply. The first interpretation might be true for Case 3 as well as the general phenotypic similarity of Asian epilachnines. But it is unlikely for Cases 1 and 2, since the elytral pattern shared by the species of Cases 1 and 2 are rather exceptional for epilachnines. On the other hand, the last interpretation is applicable to all the three cases. In particular, the phenetic similarity of *E. orthofasciata* to either *E. bifasciata* or *E.* sp. G in Case 1 is probably a convergence, because the medial fascia of *orthofasciata* is almost certainly composed of two spots, 3 and 4, whereas that of *bifasciata* or sp. E of three spots, 4-3-5. Thus, we could conclude that the similar elytral patterns in at least Cases 1 and 2 are outcomes of convergent evolution. We consider that these cases are examples of Müllerian mimicry, because of the following reasons.

1) Epilachnines, as well as other coccinellids, are among the examples of distasteful insects and are often regarded as models of Batesian mimicry. Both adults and larvae have bitter body fluid, and if they are frightened, they secrete the body fluid from knee joints (= reflex bleeding).

2) It is likely that predators need certain experience before they recognize that epilachnines are distasteful.

3) The epilachnine species in question are all in low density, and except for Case 3 the sympatric species occur on different kinds of plants growing in undisturbed habitats.

4) Then, if each species has a unique warning color or pattern, the predators must spend long time before they make search images to various colors or patterns.

5) Thus, it is beneficial for the epilachnines to have similar elytral markings; this makes construction of search image by the potential predators easier even if each individual prey species is in low density and occurs on different kinds of plants.

In all the three cases above the body size of component species was similar. This suggests that predators are fairly sensitive to size of their prey and they can discriminate between different sizes of insects even though they are very similar in other respects.

ACKNOWLEDGEMENTS Part of the present paper that deals with Javanese epilachnines formed part of the doctoral thesis by Sih Kahono submitted to Kanazawa University. We wish to express our thanks to the following specialists who kindly identified food plants of epilachnine beetles: Dr. D. Symon (Botanic Gardens of Adelaide and State Herbarium, Australia; Sumatran Solanaceae), Dr. C. Jeffrey (Royal Botanic Garden, Kew, England; Sumatran cucurbits), Dr. H. Koyama (National Science Museum, Tsukuba; Sumatran species of *Mikania*), Dr. H. Nagamasu (Kyoto University; other Sumatran species), Dr. T. Yahara (University of Tokyo, now Kyushu University; a part of Urticaceae), and Dr. H. Ohashi (Tohoku University; *Centrosema pubescens*). Dr. Y. Shirai (National Institute of Agro-Environmental Sciences) kindly allowed us to cite his observation concerning *Epilachna vigintioctopunctata* in the peninsular part of Malaysia. We also extend our thanks to Messrs. Asril, Z. Patriyanus, M. Koto, T. Sota, F. Ito, K. Matsumoto and many other persons for their assistance in field survey. S. N. wish to express his thanks to Professor Emeritus S. Kawamura (Kyoto University), Professor M. Hotta (Kagoshima University) and INPEX Foundation for their generous support during his stay in Padang, Indonesia. This study was carried out with the permission of Lembaga Ilmu Pengetahuan Indonesia (LIPI), and was funded partly by Grants-in-Aid for International Scientific Research from the Ministry of Education, Science, Sports and Culture of Japan (Nos. 02041033, 05041086, 08041141) and the Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (JSPS) (11691161).

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Received Sept. 2, 1999
Accepted Sept. 26, 1999

片倉晴雄，中野進，Sih Kahono，Idrus Abbas，中村浩二

スマトラおよびジャワのマダラテントウ類

1981 年から1998 年の間にスマトラ，ジャワで確認された26種のマダラテントウを列挙し，斑紋パターンと雌雄生殖器を図示した。この26種の内訳は，“*Henosepilachna*” 11種，“*Epilachna*” 13種，*Afidenta* 1 種，所属不明種が1 種であった。各々の種の食草を示し，いくつかの自然史学的な項目について付記した。