

AN ANALYSIS OF THE JAPANESE CERAMBYCID FAUNA WITH SPECIAL REFERENCE TO DISTRIBUTION BELTS¹

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In analyzing the Japanese cerambycid fauna, an examination of the geographical origins of the elements has been possible from the world-wide point of view, because many valuable contributions have been made by S. Breuning, J. L. Gressitt, E. G. Linsley and other authors on almost every aspect of the study of longicorn beetles in recent years (systematics, zoogeography, ecology and others).

As careful records have been made attending to relations between the seasons of appearance and activity of beetles, seasonal changes in their vertical distribution, and their precise horizontal distribution in Japan, it is clear that it is impossible to accurately explain the complicated true situation by simple indication of the conventional geographical distribution. As the result of recording on a map the precise distribution pattern of each species, it becomes clear that the pattern of each species is distinct, and is discontinuous. When consideration is given in addition to the accompanying data on the relation between the season of their appearance and the change of their vertical distribution, the following three principal types of situation can be found:

1. The distribution pattern has much thickness, namely in spring it appears in the plains or lower mountainous regions, and the altitude inhabited becomes higher with the passing of months, and it is found at high elevations in summer. In this case, the recent origin or the closely allied forms of the species may be traced northward from the pattern. Such species should be rather young and also dominant.

2. The distribution pattern has much less thickness, namely it only appears at a certain altitude and has a very short season, and it has never been found in other localities or seasons. If the species appears in summer at high elevation, it is usually a non-endemic of a northern type or an endemic having close allies in the north. But, if it appears in summer on the plains of SW Japan, the SW maritime province or adjacent islands, its origin or its close allies can be traced southward. (Some of these were named the longicorn beetles of insular or oceanic weather. Hayashi, 1949) Additionally, it appears in intermediate elevations and for a very short season, and its distribution pattern is very much restricted, the species should be an old one being very much isolated, and it is difficult to immediately trace its relationships in any direction. It frequently represents an endemic.

1. This paper was read at the general meeting for 1959 of the Kinki branch of the Entomological Society of Japan in Osaka, May 31st, 1959. The study was partly aided by a governmental grant for scientific researches (encouraged studies) for 1959 from Department of Education.

3. The intermediate case between 1. and 2. (Hayashi, 1957). The result of studies relating to these situations in Japan will be reported in the future.

As to the problems relating to two species having very close affinities morphologically, or to so-called sibling species which have hitherto been ranked as one species, if they are found in the same locality, it is very useful to consider data relative to their host specificity, season of appearance and their activities. If they appear at the same time, there may be found differences in their vertical distribution. It also may contribute toward preventing falling into subjective identification and to make possible greater accuracy in the study.

Judging from the host selection this may only be utilized for rather developed groups, because many cases are found in which the life zone of plants, including the host, limits the distribution of the cerambycid. But, utilization of the host selection habit in comparatively primitive groups seem to be less useful, because they usually live upon seasoned or decaying woods, showing a polyphagous tendency and not such strict selection. Also, it may be less definitive when the mother beetles' ovipositing habit is influenced by the temperature or humidity of the wood. Unfortunately the hosts of many Japanese cerambycids are still unknown.

In Japan (from Hokkaido south to Amami-Oshima I., incl. Bonins) there are 529 known forms (incl. subsp.) belonging to 231 genera (incl. subgenera) of 57 tribes in 6 subfamilies of Cerambycidae. These numbers include a few undescribed species and genera.

I plotted the distribution patterns of each species and genus on maps, along with their close allies. Judging from the maps, the distribution patterns of every species or

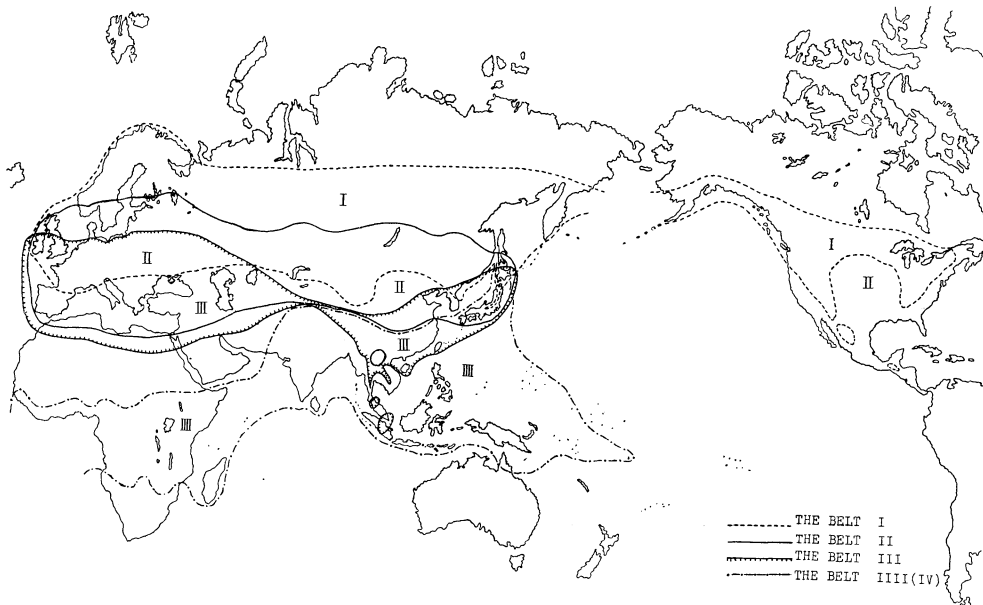


Fig. 1. The distribution belts. The lines show the maximum borders. Belt II is also extending to the temperate zone of North America, but I cannot plot it, because the detailed distribution patterns of the representatives are not clear to me at present.

genus occurring in Japan and in the surrounding regions can be classified in four large *distribution belts* named herein (fig. 1). In the following discussion, some dominant genera, comprising many species, and which cannot be separated into subgenera at present, have very broad distribution patterns, and cannot be assigned immediately to any one of the four belts. These genera are counted in each belt in which their representatives are found. They are: *Aredolpona* (1, 2), *Anoplocleromorpha* (1, 2), *Leptura* (1, 2, 3), *Strangalia* (1, 3, 4), *Obrium* (2, 3, 4), *Xylotrechus* (1 to 4), *Clytus* (1, 2, 3), *Chlorophorus* (2, 3, 4), *Monochamus* (1, 3, 4), *Mesosa* (*Mesosa*) (1, 3, 4), *Mesosa* (*Aphelocnemis*) (2, 3, 4), *Olenecamptus* (2, 3, 4), *Pterolophia* (2, 3, 4), *Pogonocherus* (1, 2), *Menesia* (2, 3, 4), *Oberea* (2, 3, 4), *Saperda* (1, 2).

The patterns of the following genera should probably be chiefly classed as belonging in Belt IV, additionally overlapping to Belt III: *Megopsis* (*Aegosoma*), *Margites*, *Pyrestes*, *Chloridolum* (*Chloridolum*), *Perissus*, *Demonax*, *Rhaphuma*, *Cypriola*, *Anoplophora*, *Batocera*, *Apriona*, *Mesosa* (*Perimesosa*), *Moechotypa*, *Niphona*, *Exocentrus*, *Glenea* (*Glenea*), *Paraglenea*, *Nupserha*. For instance, judging from the pattern of *Glenea centrogruttata*, *Glenea* (*Glenea*) must also belong to Belt III, in spite of there being nearly 500 species of congeners in Belt IV (and Africa) (fig. 2).

And the following three chiefly belong to Belt III, in addition to overlap to Belt IV: *Chelidonium*, *Leontium*, *Purpuricenus*.

Belt I is the most northern one and is represented by the mass of distribution patterns of *Tetropium*, *Pachyta*, *Evodinus*, *Molorchus* (*Molorchus*), *Callidium*, *Acanthocinus*, *Saperda*, extending from Japan (high elevations of NE region), through Sachalin, Siberia to N. and etc. C. Europe, partly as far as the high elevations of the Alps (and also N. America). These genera may be ecologically recognizable chiefly as the groups attacking conifers and some northern types of deciduous trees and they appear to be limited by the coniferous forest zone distributed over the northern regions of the Eurasian and N. American continents.

Belt II is somewhat obliquely placed just south of Belt I, from Japan (temperate zone), through Ussuri, Amur, North China (incl. Manchuria), Mongolia, NW Himalayas, C. Asia, as far as C. and S. Europe, formed by the mass of the distribution patterns of *Prionus*, *Pidonia*, *Gracilia*, *Trichoferus*, *Molorchus* (*Linomius*), *Rosalia*, *Chloridolum* (*Parachloridolum*), *Plagionotus*, *Paraclytus*, *Semanotus*, *Parechthistatus* (?), *Asaperda*, *Anaesthetis*, *Miccolamia*, *Agapanthia*, *Eumecocera*, *Phytoecia* (*Phytoecia*), etc. Of these, *Agapanthia* and *Phytoecia* are notorious stem-and root borers of grassy plants and the principal indicators for steppe or grassy plains of the inner continent of Eurasia, along with *Dorcadion*, *Neodorcadion* and *Eodorcadion* which are not found in Japan (Hayashi, ms.). The other members chiefly attack rather northern types of deciduous trees or conifers of the temperate zone.

Belt III is a rather southern one represented by the mass of the patterns of *Psephactus*, *Arhopalus* (*Cephalallus*), *Lemula*, *Pygostrangalia*, *Parastrangalis*, *Formosopyrrhona*, *Stenygrinum*, *Stenodryas*, *Pseudaolesthes*, *Leontium*, *Chelidonium*, *Anaglyptus*, *Purpuricenus*, *Dere*, *Psacotha*, *Mecynippus*, *Uraecha*, *Cylindilla*, *Aulaconotus*, *Pareutetrappa*, *Paraglenea*, *Epiglenea*, etc., extending from Japan (SW region) and arcuately curving southward through Formosa, SW China, the bases of the Himalayas, C. Asia, Asia Minor, the Mediterranean region and C. Europe. In Japan, these genera chiefly attack more southern types of broad leaved deciduous trees or shrubby plants in the rather warm, subtemperate zone.

Belt IV is the most southern one extending from Japan (SW region, maritime pro-

vinces and adjacent islands), through Ryukyu, Formosa, the coastal region of China, SE Asia, India south of the Himalayas, the Malay Archipelago, as far as Africa, or from Japan, through Idzu and Bonin Islands, as far as the Pacific Islands. The belt should be subdivided into further distinguished belts in the future. It is formed by the mass of the patterns of *Eurypoda*, *Distenia*, *Neosalpinia*, *Ephies*, *Nysina*, *Ceresium*, *Stenhomalus*, *Stromatium*, *Xystrocera*, *Kurarua*, *Leptepania*, *Epania*, *Merionoda*, *Macromolorchus*, *Thranium*, *Eurybatus*, *Artimpaza*, *Cleomenes*, *Dolophrades*, *Dolichoprosopus*, *Nanohammus*, *Xenicotela*, *Palimna*, *Rhodopina*, *Olenecamptus*, *Xenolea*, *Euseboides*, *Bumetopia*, *Abryna*, *Mesosella*, *Apomecyna*, *Ropica*, *Atimura*, *Sybra*, *Sophronica*, *Mimectatina*, *Diboma*, *Pothyne*, *Miaenia*, etc. These often attack allies of hosts of members of the Belt III, but of the more southern type adapted to more warm and humid conditions, as well as seasoned and mostly decaying woods, shrubs or vines, and contain many rather primitive groups of Cerambycidae.

The following facts support the above conclusions: The Cerambycidae chiefly appearing in June at about 1000 m in altitude of Tien-mu Shan, Chekiang Prov., EC China are mainly composed of members common to Japan and their close allies whereas those appearing in July are common to Formosa and S. China or to their allies. (Gressitt, 1939, 1951; Breuning, 1956). When a species has a distribution pattern independent from the main pattern of the genus, it is judged separately. For instance, the pattern of *Moechotypa*

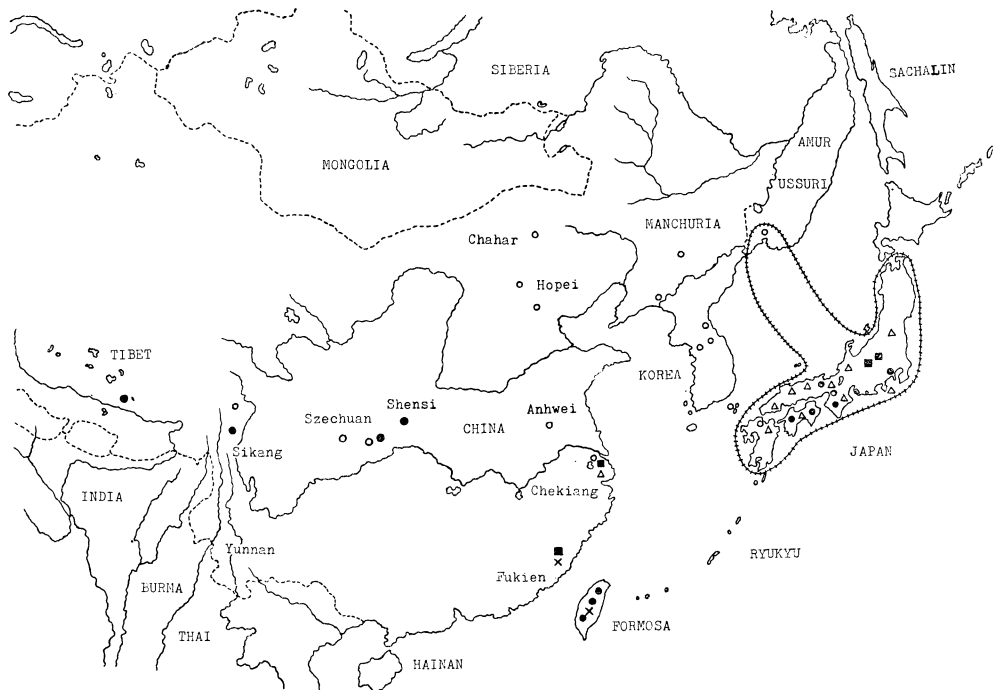


Fig. 2. The distribution of some Cerambycidae of Belt III. ●: *Glenea centroguttata* Fairmaire ○: *Moechotypa diphysis* Pascoe and its allies, *M. alboannulata* Pic (Szechuan, Sikang) and *M. semenovi* Heyrovsky (Szechuan) ■: *Lemula japonica* Tamanuki and its ally, *L. coerulea* Gressitt (Chekiang, Fukien) △: *Lemula nishimurai* Seki, *L. rufithorax* Pic and their ally, *L. testaceipennis* Gressitt (Chekiang) ×: *L. setigera* Mitono (Formosa) and *L. inaequalithorax* Pic (Fukien). ###: *L. decipiens* Bates.

diphysis lies over Japan (Osaka, Fukuoka), Tsushima, Korea, C. and N. China, and 18 of the 21 species of the genus are found in Belt IV, and two very restricted species which are closely related to *M. diphysis* are found in Szechuan and Sikang, W. China. Then it is judged to belong to Belt III (fig. 2).

With regard to endemics, the belt to which the genus or species must be related is decided systematically after careful consideration of the closest allies, with the assistance of the distribution pattern of the species, genus or tribe. For instance, in *Jezohammus nubilus*, it appears on the plains of Hokkaido in June to July, and in the mountainous regions of Honshu and Shikoku in July to September. *Jezohammua* was classified as the closest ally of *Xenolea*, by Matsushita, Breuning and me, and Gressitt synonymized it with *Xenolea*. In spite of the fact that its pattern shows as some isolated or interrupted areas scattered in temperate and subtemperate zones in NE Japan, it is judged as an endemic influenced from Belt IV in the light of the fact that the patterns of all Xenoleine genera are limited to Belt IV, only excepting the very narrow coastal region in S. China (fig. 3).

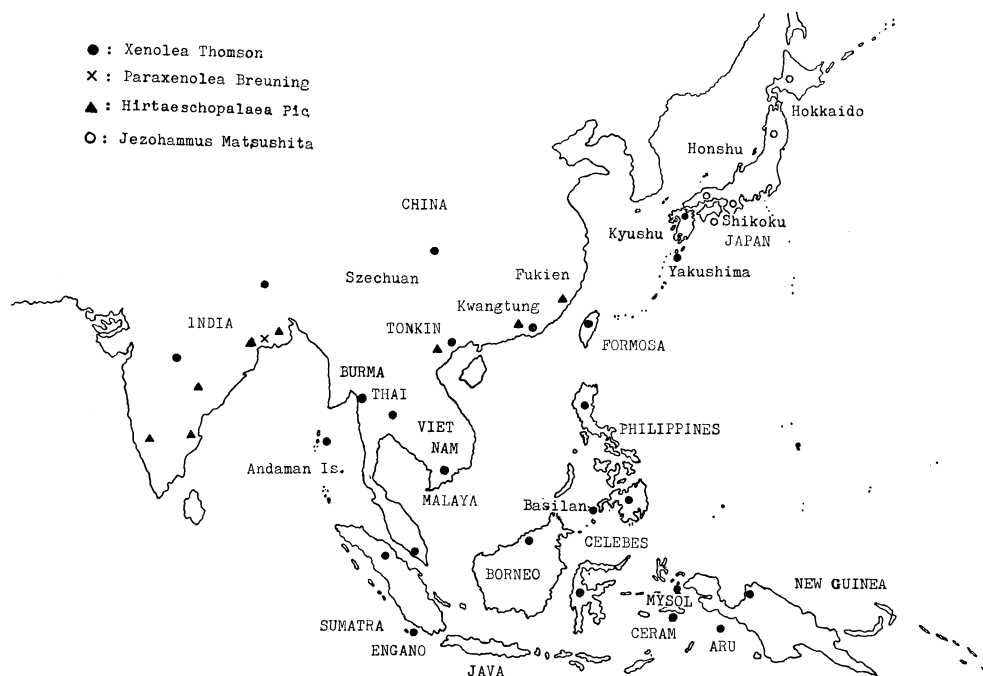


Fig. 3. The distribution of the species and genera of the tribe Xenoleini, representatives of Belt IV.

Of course, some of the judgements in this report may be changed by future study, but it seems to me that this method does not permit extreme errors in judgement. However, I cannot decide the accurate positions of four endemic genera of Lamiinae. For a long time, *Eupogoniopsis tenuicornis* was placed in *Eupogonius*, which is dominant in Central and South America, and it was recently recognized as a monotypic and endemic genus

from Japan by Breuning. As *Estoliops fasciatus* was originally described as one of the allies of *Graphidessa*, it seems to me the genus has not so close affinities to the latter. When he described *Graphidessa venata*, Bates pointed out it had some relation to the New Zealand genus *Tetrorea*. An Acanthoderine, *Callapoecus guttatus* does not seem to relate so closely to *Acanthoderes*, the principal representative of the tribe in the Eurosiberian region.

Additionally three endemics, *Xenophyrama*, *Ohbayashia*, *Pyrrhona* and the non-endemic *Enoploderes* seem to have closer relationships to *C.* Asian representatives than to any one of the other regions.

Arhopalus (*Megasemium*), *Encyclops*, *Sachalinobia*, *Callidiellum* and *Plectrura* are common to NE Asia and N. America, having endemic species or subspecies in each district (I recorded *Encyclops olivaceus* as a new Japanese element, 1953).

Leptoxenus, unique Asian representative of the Ibdionini, a tribe which is dominant in C. and S. America, is a monotypic genus from Japan and Formosa. I could not learn in detail characters of *Falsoibidion*, which has been ranked as another of Asian Ibdionine genus from Tonkin and Cambodia.

Table I (Species)

			Prioninae	Aseminae	Disteniinae	Lepturinae	Cerambycinae	Laminae	Subtotal	Total	%
I	a	Japan-Siberia-Europe		3		12	5	7	27		
	a	Japan-E. Siberia-Altai		2		16	5	8	31	71	
	b	Endemics				9	1	3	13		18.3
II	a	Japan-Amur-Ussuri-N. China-Mongolia	1	1	1	17	35	25	80	185	
	b	Endemics	1			47	23	34	105		56.7
		Central Asia (b)				4			4	4	
III	a	Japan-SW China	2	1		2	10	26	41	108	
	b	Endemics				17	14	36	67		62.0
IV	a	Japan-Indo-malay	2			4	15	34	55	150	
	b	Endemics	1		1	3	31	59	95		63.3
		N. America (a)		1		1	2	1	5	6	
		N. America (b)				1			1		
		C. & S. America					1		1	1	
		Uncertain (b)						4	4	4	
	a	Subtotal	5	8	1	52	73	101	240		
	b	Subtotal	2		1	81	69	136	289		
		Total	7	8	2	133	142	237		529	

Note: a. Non-endemic, b. endemic

Table I shows numbers of species recorded in Japan, according to subfamilies, distribution belts, and whether endemic or non-endemic. Table II shows numbers of genera recorded in Japan, according to the same criteria. In Table I (species), the numbers of the species are greatest in Belt II, followed by Belts IV, III and I in that order. Also in Table I it is noticeable that endemics are very numerous, 289: 529 (54.6%). Occurrence of endemics is highest in Belt IV, 95: 150 (63.3%), followed in order by III, 67: 108 (62.0%), II, 105: 185 (56.7%) and I, 13: 71 (18.3%).

These statistics are somewhat different from the general opinion on the insect fauna of Japan held by recent Japanese authors. It is noteworthy that H. W. Bates (1873) was surprised there were high percentages of tropical elements in Japanese Cerambycidae based on the materials chiefly collected by George Lewis from Nagasaki, Hyogo (Kobe), Osaka and Yokohama, and he (1884) pointed out there were also tropical elements among large numbers of so-called palearctic species and genera found in the collections made in most parts of Japan by Lewis in 1880 and 1881.

For such discussions, it seems to me that special consideration is needed relating to

Table II (Genera)

			Prioninae	Aseminae	Disteniinae	Lepturinae	Cerambycinae	Laminae	Subtotal	Total	%
I	a	Japan-Siberia-Europe		4		18	7	9	38	38	16.5
	b	Endemics									
II	a	Japan-Amur-Ussuri-N. China-Mongolia	1	1		16	21	18	57	64	27.7
	b	Endemics				5		2	7		
		Central Asia (a)				1			1	4	
		Central Asia (b)				3			3		
III	a	Japan-SW China	2	1		8	19	33	63	67	29.1
	b	Endemics						4	4		
IV	a	Japan-Indo-malay	2		1	5	31	50	89	99	43.0
	b	Endemics			1		2	7	10		
		N. America		1		2	1	1	5	5	
		C. & S. America					1		1	1	
		Uncertain (b)						4	4	4	
		Numbers overlapping	1			6	18	26	51	51	
	a	Subtotal	4	7	1	44	62	85	203		
	b	Subtotal			1	8	2	17	28		
		Total	4	7	2	52	64	102	231		

the probable different speed of development of each species in nature. Thus, there are many monotypic or restricted genera having few congeners and individuals, and on the other hand, there are many dominant genera comprising many species which have very many individuals and variations. In this case, the idea young or old in their history of development may be recognizable. 24 endemics of *Pidonia* appear in 47 (in II, b, Lept. in Table I) and also 5 non-endemics are found in 17 (in 2, a, Lept.). This suggests that it may also be necessary to revise the category of the "species" of *Pidonia* in the near future, even if the species seem to be young.

In Table II (genera), the largest number of genera is found in Belt IV, 99 (43.0%), and the order of the remainder follows: III, 67 (29.1%) II, 64 (27.7%) to I, 38 (16.5%).

Also in Table II, endemic genera total 28, and 10 are found in Belt IV; *Tengius* (Dist.): *Allotraeus*, *Ogasawara* (Ceram.) : *Jezohammus*, *Kirishimoopsis*, *Nipponosybra*, *Sybrodiboma*, *Microzotale*, *Planeacanista*, *Praolia* (Lam.): and 7 in Belt II; *Japonostrangalia*, *Kanekoa*, *Pachypidonia*, *Munamizoa*, *Etorofus* (Lept.): *Mesechthistatus*, *Nipponostenostola* (Lam.), 4 in Belt III; *Microlera*, *Aragea*, *Hirakura*, *Doius* (Lam.) and 3 of the allies of Central Asia, and lastly none from Belt I. These genera are all monotypic except *Allotraeus*, *Doius* and *Praolia* which each contain two species, *Etorofus* with three, and *Mesechthistatus* with four (incl. subsp.). This last is a micropterous genus in the tribe Morimopsini, and the members probably have been divided by geographical isolation, as in *Parechthistatus* of the tribe Phrissomini and as in *Dorcadion*, *Neodorcadion* and *Eodorcadion*-complex in the tribe Dorcadionini, but the question of "species or subspecies" will have to be revised as in *Pidonia*.

In conclusion, it may be said that high percentages in the Japanese cerambycid fauna comprise the so-called southern elements belonging to Belts IV and III, and a large proportion of the endemic genera appearing in Belt IV are older, since their close allies are largely found in Formosa, Hainan, Malay Archipelago, and even in the Pacific Islands, and many of them have coarsely faceted eyes showing their nocturnal habit.

I would further conclude that the basic ancient forms of Japanese cerambycid fauna were formed by these southern elements, and this interpretation is supported by the existence of four genera in Belt III and also probably four with C. Asian allies, instead of northern ones.

In the four Japanese forms of *Lemula*, *japonica* (castaneous to pitchy, with slight metallic tint, 8 mm in body length) has the most restricted distribution pattern, appearing in high elevations of central Honshu in midsummer (the last of June to the first week of August), and is closely related to *coerulea* (dark metallic with dark brown, 7-8 mm) which was found at about 1000 m in alt. at Tien-mu Shan, Chekiang, on 9 June, and also was recently recorded from Kuatun, Fukien, both in SE China. *L. nishimurai* (orange red, with head, antennae and legs black, 7-7.5 mm) is limited to the Chugoku mountains of SW Honshu (recently reported from Mt. Tsurugi, Shikoku), in May and June, and *rufithorax* (pale orange or pinkish testaceous, with antennae and legs black, 7.5 mm) appears from May to June in N. Kyushu, the Chugoku mountains of SW Honshu, the Shikoku mountains, Kii and Idzu peninsulas and the central Tohoku district. Both species are more closely related to *testaceipennis* (pitchy red brown, with antennae and legs blackish, 7.5 mm; described from Tien-mu Shan under the same circumstance as *coerulea*), than any of the other congeners.

L. japonica, *nishimurai* and *rufithorax* have rather restricted and thin distribution patterns. The remaining species, *decepiens* (black, with elytra, apex of abdomen and bases of femora pale yellow to castaneous brown, 5.5–7 mm), has a rather extensive and thick distribution pattern, appearing dominantly in April to July, from Kyushu, through Shikoku, Honshu to Amur at all altitudes. Thus, *japonica*, *nishimurai* and *rufithorax* may be older than *decepiens* which may be thought as a young species, and the existence of former three and two Chinese allies, indicate the main current of the genus is traced from south to Japan. Additionally, this is suggested by the existence of *setigera* from high elevations of Formosa and *inaequalithorax* from Fukien which have similar laterally untuberculated prothorax, so far as the original descriptions show, and are probably related to each other, both departing from the other members of the genus (fig. 2).

The phylogeny or past history of development of Cerambycidae must be studied from a different viewpoint than has prevailed in the past. It is necessary to judge rather longitudinally the true relation between the close allies rather than transverse scattering in the four belts and others, as in *Callidium* (1), *Semanotus* (2), *Callidiellum* and *Palaeocallidium*. I have previously studied the subgenera of *Arhopalus*, *A. (Arhopalus)*, *A. (Megasemum)* and *A. (Cephalallus)* (3), or *Molorchus*, *M. (Molorchus)* (1), *M. (Linomius)* (2) and *M. (Kobaneus)* (4) from this view point. It is necessary to accurately decide the relation between close allies among the many species of the dominant genera having very extensive and thick distribution patterns.

When this viewpoint is extended from the fauna of Japan to that of the whole world many interesting facts may be explained as for example: The existence and isolated distribution patterns of *Philus* and *Mantitheus* in Asia, *Vesperus* in S. Europe and *Vesperoctenus* in N. America, with the four Japanese endemics allied to Central Asian ones, or *Leptoxenus* in Japan and Formosa, and *Callipogon* in NE Asia and C. and S. America, etc.

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A CORRECTION

In the article by Dr. Szent-Ivany, *Pac. Ins.* 1 (4): 443, line 2 from bottom, it should have read "Dr. D. J. Williams."