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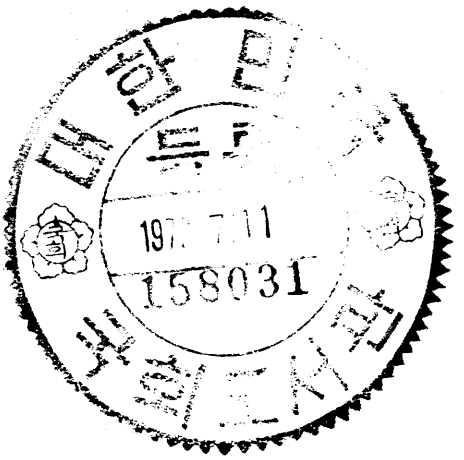

CONTENTS.

STUDIES ON THE INHERITANCE OF THE SPRING AND WINTER GROWING HABIT IN CROSSES BETWEEN SPRING AND WINTER BARLEYS

BY

NOBORU TAKAHASHI.

With Plate I-II

INTRODUCTION

Hereditary characteristics in the spring and winter growing habits of wheat and barley have been reported on by several investigators. W. J. Spillman[4] and H. P. Cooper[2] have experimented along this line with wheat, and N. I. Vavilov has worked on wheat and barley.

The writer of this article, who has made a study of the same subject for several years, has also found that the spring and winter growing habits of barley are inherited according to Mendel's Law as shown by the results of the investigators named above.

THE SPRING AND WINTER GROWING HABITS

Cooper and J. A. Clark[1] have classified wheat according to the growing habit, into three classes: (a) the winter growing habit, (b) the spring growing habit, and (c) the intermediate form. Clark considers this form of classification the best.

At the Agricultural Experiment Station in Suigen. Chosen (Corea) experiments have been carried on with barleys native to chosen as well as some varieties from other countries. Results show that these can be clearly separated according to the growing habit. With reference to the variety sown in the autumn, some survive the winter, while others do not. Some of the barley with the spring growing habit are able to survive the

winter when sown in the autumn, while others are not.

Thus the barley may be roughly classified according to the growth habit into the following classes:

1. Winter growing habit. The variety which fails to ripen when sown in the spring, but survives the winter when sown in autumn.

2. Spring growing habit. The variety which ripens when sown in the spring, but not able to survives the winter when sown in the autumn.

3. Intermediate growing habit. The variety which ripens when sown in the spring, and also survives the winter when sown in the autumn.

4. Pseudo-winter growing habit. The variety failing to ripen when sown in the spring, like a variety of the winter growing habit, and yet unable to survive the winter, when sown in the autumn.

MATERIAL AND METHOD

The following four varieties were used in this investigation: Shiromugi, a Japanese variety, and three native corean varieties, Teisen, Chûshûshiro and Zairaishu. The first mentioned is of the spring growing habit, and the last three are of the winter growing habit.

This investigation deals mainly with the barleys sown in the spring, but part of the F_2 and F_3 have been experimented upon with reference to their hardiness. These were sown in the autumn to ascertain the relation between the growing period and hardiness, as compared to those sown in the spring. As yet no definite conclutions have been arrived at.

Consequently, as stated aboved, the results obtained concern only those which were sown in the spring and reached maturity. We will regard these then, as belonging to the spring growing habit, while those failing to reach maturity under similar circumstances will be regarded as belonging to the winter growing habit.

Now, there may be among those referred to as the spring growing habit some which are hardy. These can be placed in either the intermediate growing habit or the spring growing habit. Likewise, there may be some among the winter growing habit which are not hardy. These can

be placed in the class of the pseudo-winter growing habit.

Further researches will be carried on to determine new factors in this phase of investigating.

EXPERIMENTAL RESULTS

Late in March, 1919, seeds obtained from an artificial crossing of Shiromugi, Teisen, Chûshûshiro and Zairaishu, were sown and the following F_1 plants were obtained:

♀ ♂	No. of F_1 plants
Shiromugi X Chûshûshiro	29
,, X Teiseu	35
,, X Zairaishu	30

F_1 plants, when planted in the spring, matured in the same period as Shiromugi, and it is also established by reciprocal crosses. This shows that the spring habit is dominant over the winter growing habit.

F_2 plants were sown in March, 1921 and the plants obtained showed that the ratio between those of the spring growing habit, and those of the winter growing habit was 3 : 1. (Simple Mendelian Segregation).

Table I. F_2 Plants.

	No. of F_1 plants	No. Observ d			No. of expect.		D	P.E.	D/.P.E
		Total	S	W	S	W			
Shiromugi X Chûshûshiro	10	846	646	200	634.50	211.50	±11.50	±8.499	1.35
Shiromugi X Teiseu	10	875	674	201	656.25	218.75	±17.75	±8.640	2.05
Shiromugi X Zairaishu	6	545	404	141	408.75	136.25	± 7.75	±6.812	1.14
Total	**26**	**2266**	**1724**	**542**	**1699.50**	**566.50**	**±24.50**	**±13.905**	**1.76**

Each individual plant of the spring growing habit reached maturity at the same time as the Shiromugi variety did, while one coming under the winter growing habit, in most cases, grows very slowly and similarily to

the winter growing varieties Chûshûshiro, Teisen and Zairaishu. Even if it succeeds in heading, it is so late, that it never becomes fully ripe.

Any individual plant of the winter growing habit can be easily distinguished from one of the spring growing habit, about the time the latter is heading. The former is sqorter and has more rugose, tender and narrower leaves.

F_3 plants showed the following results in relation to heritage. The number of plants retaining the spring growing habit as compared with those separating into the spring and winter growing habits in the ratio of 3 to I was I : 2.

Table 2. This shows the number of plants retaining the spring growing habit, and those separating into the spring and winter growing habit groups in the third generation.

	Total	Observed		Theo. (1:2)		D,	P. E.	D. / P. E.
		Const.	Seg. 3:1	Const.	Seg. 3:1			
Shiromugi X Chûshûshiro	29	12	17	9.67	19.33	± 2.33	± 1.712	1.36
Shiromugi X Teiseu	28	7	21	9.33	18.67	± 2.33	± 1.682	1.39
Shiromugi X Zairaishu	49	20	29	16.33	32.67	± 3.67	± 2.225	1.69
Total	**106**	**39**	**67**	**35.33**	**70.67**	**± 3.67**	**± 3.273**	**1.15**

Table 3. This shows the number of observations in segregating groups in the third generation.

		Observed			Theo. No.		D	P.E.	D. / P.E
		Total	S	W	S	W			
Shiromugi X Chûshûshiro	17	708	535	173	561.00	177.00	± 4.00	±7.779	0.516
Shiromugi X Teisen	21	957	722	237	719.25	239.75	± 2.75	±9.049	0.304
Shiromugi X Zairaishu	29	719	536	183	539.25	179.25	± 3.25	±7.837	0.615
Total	**67**	**3386**	**1793**	**593**	**1789.50**	**596.50**	**± 3.50**	**±14.260**	**0.245**

With reference to the rate of segregation on the part of each line belonging to the segregating groups shown in the above table, the deviation against the wintergrowing rate (25%) with the exception of only three lines, exceeds the P. E. (Probable error) by not more than five times.

The following table shows the variation regarding the deviation of the segregating rate observed in the case of group 64, where the deviation does not exceed the P. E. by more than five times.

D/P.E.	−5	−4	−3	−2	−1	0	+1	+2	+3	+4	+5
Exp. no. of group.	3	6	9	8	9	14	5	6	2	2	64
Theo. no. of group.	1.58	3.11	6.35	9.44	11.52	11.52	9.44	6.35	3.11	1.58	64

P. = 0.438243

As was previously stated, plants of the winter growing habit belonging to the group F_2 seldom form heads, and if they do, they seldom ripen. However in the year 1921, seeds were obtained from some which did ripen, and these were sown in the autumn. Seven plants survived the winter, and seeds obtained from these were sown late in March 1923. The following table shows that all the plants had to a predominant degree the characteristics of those of the winter growing habit.

Table 4.

	F_3	Observed F_4 plants		
		Total	S	W
Shiromugi X Chûshûshiro	2	131	0	131
Shiromugi X Teisen	3	161	0	161
Shiromugi X Zairaishu	2	130	0	130
Total	**7**	**422**	**0**	**422**

This shows that the plants of the spring growing habit are ratio of 3 : 1 in the second generation.

Along this line Cooper has reported as follows: "With regard to the crossing of plants the spring growing habit with those of the winter growing habit, in the second generation the former wields complete predominancy over the latter, the narure and characteristics of the latter lying completely latent, but in the second generation, the crossed sometimes separate themselves into the former group, and the latter at the rate of 3 to I and the others at the ratio of 13: 3. "

It is obvious then, that there are some factors causing the spring growing habit to predominate over the winter growing habit, and other factors serving as a restraint to the selfassertion of the winter growing habit in the crossing process.

The genetical formula for the winter growing variety is "SSii", while the formula for the spring growing variety is twofold, one being "ssII" and the other "SSII".

Experiments carried on so far in crossing barley of the spring growing habit with those of the winter growing habit have given a hereditary ratio of 3 : 1 and not 13 : 3 as reported by Cooper.

However, Gaines[3] and Vavilov have found that by crossing two spring barleys, winter forms were obtained in the second generation. It seems then, that the varieties Chûshûshiro, Teisen and Zairaishu all of the winter growing habit, can be designated by the symbol "SSii" and the variety Shiromugi of the spring growing habit by "SSII".

SUMMARY

The barley, according to its growth habit may be classified into varieties as follows: (a) winter growing habit, (b) spring growing habit, (c) intermediate growing habit, and (d) pseudo-winter growing habit.

When barley of the spring growing habit is crossed with barley of the winter growing habit, the former is dominant over the latter, and in the F_2 generation segregate into the ratio of 3 : 1.

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varieties, *U. S. Dep, of Agri, Bul.* No. 1074. (1922), 23-25.

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EXPLANATION OF PLATES

PLATE I

Fig. 1. *Chûshûshiro and Teisen* (winter growing habit varieties sown in the autumn)
Fig. 2. „ „ („ „ „ „ „ the spring)
Fig. 3. *Shiromugi* (Spring growing habit variety sown in the spring)
Fig. 4. *Prince Koshu and Tanpi* (Pseud-winter growing habit varieties sown in the spring).

PLATE II

Fig. 5. F_2 plants of *Shiromugi and Teisen* (Sown in March, 1921)
Left: the spring growing habit.
Right: the winter growing habit.

1

3

2

4

S. Muramatsu Phot.

S. Muramatsu Phot.

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STUDIES ON THE PEAR-STEM GIRDLER,

Janus piri n. sp.

BY

Hanjiro Okamoto and Shigeru Muramatsu

Government Entomologist.

With Plate III.

CONTENTS

—:o:—

I. INTRODUCTION.

In May, 1919 there was sent to the Government-General Agricultural Experiment Station at Suigen a quantity of pear twigs from the Experiment Station at Keishôhoku-dô with a request for the name and the life history of the insect responsible for it. It was peadily evident that this was a stem girdler, and this was the first indication of the presence of such an insect upon pear in Corea. Shortly thereafter the same type of injury was noticeable upon pear trees n tihe pear growing sections of Taiden, Chuseinan-do; Suigen, Keiki-do; Rashû, Zenranan-dô; etc. During 1920 the pear trees in the orchards of this station were severely injured, and investigations were consequently made upen its life history and habits. The results of our studies are given herewith.

II. CLASSIFICATION AND DESCRPITION.

The pear-stem girdler dealt with in this paper belongs taxonomically to the order *Hymenoptera*, family *Cephidae* and genus *Janus*. Several species of this genus have been described from the Palaearctic region and America, but this species differs from them in its morphological characters and in the host plant attacked. However, one of tho European species (*Janus compressus*) occurs upen pear, but is distinguishable by the coloration of the abdomen and legs. The species here described is therefore new to science and has been given the name *Janus piri* n. sp.

Janus piri n. sp.

Adult female: Body polished black; clypeus, mandibles (except their reddish-brown apices), palpi, the two large spots on the posterior lateral margin of the pronotum, tegulae, the small spot on the frontal angle of the mesopleuron and the large triangular, membranous part on the first abdominal segment bright yellow. Legs largely yellow; base of coxae black, femora yellowish-brown, apices of hind femora and basal extremeties of hind tibiae dark-brown, tarsi and claws yellowish-brown. wings hyaline and irridescent, with stigma and nervures dark-brown. The posterior lateral portions of the second to sixth abdominal segments very slightly brownish.

Body with a minute grayish pubescence, this more conspicuous on the abdomen than on other parts. Antennae of twenty four segments, filiform, the third joint slightly longer than the fourth; covered with a minute brownish-black pubescence which is conspicuous on the first, secend and third joints. The face and clypeus with sparse grayish-colored hairs; the apical margin of the clypeus nearly truncate. Mandibles stout, the rigat tridentate, with the upper tooth largest and the middle one smallest; the left mandible bi-dentate and both teeth of the same size. Vertex and pronotum polished, and with very minute punctures. The punctures on the mesonotum larger and more numerous than on the pronotum. wings (pl.III.fig.5) with a uniform microscopic pubescence; the base of the radial sector atrophied. Hind tibiae with two preapical spurs and middle tibiae with one. Claws bifid. The first abdominal segment divided in the middle forming the large triangular, membranous portion. The sheath long and projected, with darkbrown hairs, the sides about parallel as viewed from above, and the upper and lower margins narrowed towards the apex, which is not pointed. The brown saw-like ovipositor curved slightly downwards and with twenty-one minute teeth on the upper edge, and thirteen of peculiar shape on the lower edge.

Length of body.....11 mm.
Length of antenna ..... 5 mm.
Length of fore-wing.....12.5 mm.

Adult male (Pl, III. fig. 3): This sex differs from the female in the

following points;

i. Antennae of twenty-one to twenty-three joints, slender, and with the flagellum brown in color.

ii. Legs bright-yellow, the small portion at the base of the coxae black, the apices of the posterior femora somewhat dark-brown, and the claws brown.

iii. Hypopygidium and each side of the eighth ventral segment yellow.

Length of body ..... 7.5 mm.
Length of antenna ..... 46. mm.
Length of fore-wing ..... 11 mm.

The egg: (Pl. III. fig. 4) Milkish-white in color and elongate, curved and somewhat crescent-shaped in its lateral aspect. Both apices somewhat poin ted. The average measurements of 10 eggs are; length 1.3 mm., and width 0.3 mm.

Mature larva: (Pl. III. fig. 2) Cylindrical in form and yellowish-white in color, with the head light brown, mandibles clypeus and labrum dark-brown. Mandibles very stout. Maxillae, maxillary palpi and labium milkish-white. Antennae of five segments, pointed. Ocelli milkish-white. The vertex sparsely covered with short dark hairs. Each segment of the body with many wrinkles, the spiracles light-brown. Thoracic segments more developed than those of the abdomen, and with rudimentary legs; the latter without legs, but with a short dark-brown process (suranal) around which are short brown hairs.

Length.....8-10 mm.

Pupa: (Pl. III. fig. 1) of the free type, and milkish-white in color with a yellowish tinge. The head, thorax and abdomen separated by deep constrictions. The head flat-globular in form, with the eyes shining black. Antennae long, reaching the ninth abdominal segment in the male and the fourth in the female. Thorax convex, with the wings elongate and reaching the third abdominal segment. Abdomen narrowed baudad, and with a process at the tip.

III. DISTRIBUTION.

As far as known at present this species is restricted to Corea alone. Its distribution in this country, on the basis of data now available, is as follows:

Taikô, Tôson, Waikan, and Kinsen, Keishôhoku-dô;

Sanrôshin and Fusan Keishônan-dô;

Taiden, Chûseinan-dô;

Rashû, Zenranan-dô;

Suigen and Heitaku, Keiki-dô; and

Heijô and Chinnanpo, Heiannan-dô.

IV. LIFE HISTORY AND HABITS.

The egg stage. The egg is never laid in old twigs but always in the pith of the young shoots, In most cases those on the southern side of the tree are chosen, and which are 2 to 3 inches in length. The point of oviposition is about half-way between the base and the tip of the shoot.

After fertilization the females search out a suitable shoot and commence its perforation with the ovipositor. The position at this time is always with the head directed towards the base of the twig. The curved, saw-like ovipositor is gradually forced into the shoot for its entire length and the egg then deposited in the pith. The entire operation requires about 5 minutes. Immediately thereafter the female moves up the twig an inch or more from the point at which the egg was laid and girdles the stalk by 2, 3 or 4 thrusts of the ovipositor, which is driven into the shoot and then worked outwards, thus making a horizontal cut, which interrupts the flow of sap.

The period during which oviposition takes place ranges from the latter part of April to the early part of May. The eggs are laid largely during the time from 10 am. to 1 pm. and on clear, warm, windless days. Fewer eggs are laid during cool and rainy weather.

A single egg is laid in each shoot, and 8 or 9 may be deposited in a short period of time, after which none are laid for 2 or 3 days, the process then being repeated. These periods of oviposition may recur 2 to 4 times, thus making the total number of eggs from a single female range from 16 to 36.

The egg, which at first is milkish-white in color, changes to yellow after 4 days, the eye-spots also becoming evident. From this time on it is possible to observe the development of the embryo. A few days later it assumes a reddish-purple tinge, and the form of the larva within the chorion can then be seen under the microscope. As the time for hatching approaches the larva shows signs of movement and finally bites away a portion of the anterior end of the chorion and emerges. About 8-10 elapse in the egg stage and hatching occurs largely between 10 am. and 1 pm.

The larval stage. Immediately after hatching the larva bores into the pith, and the tunnel is always about 3 cm. below the point girdled. It is filled by excrementous matter voided by the larva. About November the full-grown condition is attained and a pupation chamber is bored out in the woody part of the old twig, and within which a thin gray cocoon of the texture of hardened mucilage is formed, and in this condition the winter is passed.

The pupal stage. At the time of transformation the pupa is milkish-white in color, but in 2 days the head, eyes and wings become darkened, and in 5 days the antennae, dorsal surface of the thorax, the abdomen and all the legs also become dark. One week after pupation the body is entirely black.

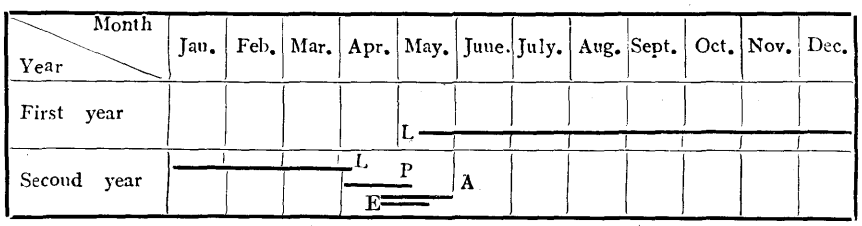
The length of the pupal stage is 8 to 9 days, and emergence is effected through a small hole eaten away at the anterior end of the cocoon by the adult.

The adult stage. The males emerge several days prior to the females, and the normal length of life of the former is 14 days as compared with 18 to 19 days for the latter. Both sexes are vary active and may be commonly observed flying about or among the foliage from 10 am. to 3 pm. on bright days. on clear, warm days copulation and oviposition take place at this time. During bad weather they remain quiescent upon the foliage.

Life cycle. This insect has a single generation each year, and the winter is passed in the mature larval stage within the cocoon in the pupation

chamber previously prepared in the woody portion of the twig. During the middle and latter part of April pupation takes place, and the adults emerge in the latter part of that month or early in May. The eggs are laid in the pith of the shoots very shortly thereafter. Hatching occurs 7 to 8 days later and feeding takes place upon the pith. In October and November the woody portion of the old twig is reached and here the cocoon is formed.

Chart I. The life cycle of *Janus piri*.



L.....Larval stage
P.....Pupal stage
A.....Abult stage
E.....Egg stage

V. EXTENT OF DAMAGE IN PEAR ORCHARDS.

As previously mentioned, the eggs are laid in the pith of the young shoot, this then being girdled a short distance outwards. The point of oviposition is evident merely as a minute black spot, but the girdling causes the immediate wilting and death of the tips of the twigs, and this is very serious from the orchardists peint of view. The appearance of injured trees is very much the same as that caused by *Laspeyresia molesta* when it attacks the shoots of peach or pear trees. (pl. III. big.6) Growth is interrupted, and in the case of young trees, or where they must be trained for a certain type of growth, this form of injury is very serious. This insect pest is becoming very abundant and it appears that the profits from pear growing in Corea will in consequence be somewhat reduced.

VI. HOST PLANTS. AND VARIATION IN DEGREE OF INJURY.

As far as known at present this saw-fly confines its attack solely to

pear trees (*Pyris spp.*) The European pear (*Pyris communis*) is attacked to a greater extent than the Japanese pear (*Pyris certiana*). Thus in mixed plantings the former may be seriously damaged while the effect on the latter is very slight. Among European pears the degree of susceptibility is dependent upon the variety, and observations in the orchards of this station in respect to this point may be summarized as follows;

1. Varieties seriously attacked;
   P. Barri, Flemish Beauty, Buffum (*Buffam*), *Le Conte, Doyenne du Comice, Doyenne d' Hiver* and *Duchesse D'Angoulemc.*
2. Varieties attacked moderately;
   Passe Crassane and *Bartlett.*
3. Varieties attacked slightly;
   Louise Bonne de Zersey, Kieffer, Andre Desportes, Lawrence and Idaho.

VII. CONTROL.

1. In the early spring before the buds begin to open, the injured twigs, which may be recognized by a more or less swollen condition at the base, should be cut out and burned, thus destroying the hibernating larvae and such pupae as may be present. Though this method is somewhat laborous yet the increased returns justify the effort.

2. The withered shoots must be pruned off during the latter part of April or early in May, thus destroying the eggs and young larvae. At this time adults may also be collected.

EXPLANATION OF PLATE

PLATE III

Janus Piri n. sp.

Fig. 1. Pupal (X VII)
Fig. 2. Larva (X VI)
Fig. 3. Adult (X VI)
Fig. 4. Egg (XXII)
Fig. 5. Wings (X VII)
Fig. 6. Oviposited and injured Shoot. (natarel size)

Y. Hasegawa del. and S, Muramatsu phot.

THE MECOPTERA OF COREA

By

Hanjiro Okamoto, *Nogakuhakushi.*

Government Entomologist.

With Plate IV, V.

Of the Mecoptera of Corea only three species, *Panorpa approximata* Esben-Petersen, *Bittacus sinensis* Walker and *Bittacus quaternipunctatus*× Enderlein, have hitherto been described and recorded. Now, in examining the collection of the Agricultural Experiment Station, Government-General of Chosen, and my own, I find ten species belonging to the order, three of which are new to science and five new to Corea.

1. Panorpa approximata Esben-Petersen

Panorpa approximata Esb.-Peters., Ent. Medd. Köbenhavn, p. 223(1915); Id., Coll. Zool. Edm. de Selys Longchamps, Fasc. 5, Mecoptera, p. 52, figs. 56, 57 (1921); Okamoto, Bull. Agr. Exp. Sta., Gov.-Gen. Chosen, Vol. 1, No. 2, P, 71, Pl. X figs. 1, 5, 10 (1924).

Loc.: The island of Saishiu, 5♀, 10♀ in alcohol, H. Okamoto et T. Kurisue, May to June, 1922.

Very common on the island of Saishiu (*Qudpart*), which lies just off the most southern point of Corea, but not as yet seen in other localities.

2. Panorpa amurensis Mac Lachlan

(Pl. IV, fig. 2)

Panorpa amurensis Mac Lachl., Ann. Soc. Ent. Belg., XV, P. 59, Pl. I, figs. 11, 11a, 11b (1872); Esben-Petersen, Coll. Zool. Edm. de Selys

× *Quaternipunctatus* is a synonym of *sinensis*.

Longc., Fasc. 5, Mecoptera, p. 53, fig. 58 (1921).

Loc.: Kôryo, 2♂, 3♀, C. Inouye, Aug., 1919; Shakuôji, 7♂, 7♀ in alcohol, Y. Hasegawa, Aug., 1921; Shakuôji, 1♂, 3♀ in alcohol, T. Kurisue, July, 1922; Shakuôji, 1♂ in alcohol, H. Okamoto, August, 1923; Cesseiji, 1♂, 1♀ in alcohol, S. Maruta, Sept., 1923; Mt. Kongo, 13♂ and 16♀ in alcohol, T. Kurisue, M. Ochi and H. Okamoto, July to August, 1924; South Ussuri (according to Esben-Petersen).

Very common in Corea, but not yet known to occur in Japan proper. This is the first record of the species in Corea.

3. **Panorpa cornigera** Mac Lachlan

(Pl. IV, fig. 7)

Panorpa cornigera Mac Lachl., Bull. Soc. Ent. Suisse, p. 404 (1887); Miyake, Journ. Coll. Agr. Imp. Univ. Tokyo, p. 189 (1910); Id., ibid., IV, p. 338, Pl. 30, fig. 13a; Pl. 36, figs. 5, 6 (1913); Esben-Petersen, Coll. Zool. Edm. de Selys Longchamps, Fasc. 5, Mecoptera, p. 55, figs. 61, 62, 63 and 64 (1921).

Panorpa Galloisi Navás (nec Miyakê), Bull. Mus. d'Hist. nat. Paris, p. 445 (1913).

Loc.: Kôryo, 1♂, 2♀, C. Inouye, Aug., 1919; Kôryo, 3♂, 3♀ in alcohol, Y. Hasegawa, June, 1923; Cesseiji, 1♀ in alcohol, T. Kurisue and S. Maruta, July, 1923; Sharei, 1 ♀ in alcohol, Y. Hasegawa, July, 1923; Honshiu, Japan (according to Miyaké, Navás and Esb.-Petersen); Wladiwostok and South Ussuri (according to Esb.-Petersen).

The species seems to be common in Corea and Japan proper, and is new to the fauna of the former country.

4. **Panorpa orientalis** Mac Lachlan

(Pl. IV, fig. 6)

Panorpa orientalis Mac Lachl., Bull. Soc. Ent. Suisse, p. 400 (1887); Esb.-Petersen, Coll. Zool. Edm. de Selys Longc., Fasc. 5, Mecoptera, p.

51, figs. 53, 54, 55 (1921).

Aulops melania Navás, Revue Russe d'Entom., XII, p. 421, figs. 5a, 5b, 5c (1912).

Loc.: Kôryo, 1♀, 2♂, C. Inouye, May, 1919; Shakuôji, 3♀, 1♂ in alcohol, Y. Hasegawa, Aug., 1921; Sharei, 1♀, 3♂ in alcohol, H. Okamoto, Aug., 1922; Shakuôji, 4♀ and 4♂ in alcohol, H. Okamoto, June, 1923; Kôryo, 6♀, 7♂ in alcohol, Y. Hasegawa, June, 1923; Gesseiji, 9♀, 7♂ in alcohol, T. Kurisue and S. Maruta, July, 1923; Sharei, 2♀, 1♂ in alcohol, Y. Hasegawa, July, 1923; Mt. Kongo, 1♀ in alcohol, H. Okamoto, T. Kurisue and M. Ochi, August, 1924.

Very common in Corea, though have recorded for the first time, but not yet seen from Japan proper.

5. **Panorpa sibirica** Esben-Petersen

(Pl. IV, fig. 1)

Panorpa sibirica Esb.-Petersen, Ent. Medd. Köbenhavn, p. 219 (1915).

Loc.: Sharei, 1♀ in alcohol, Y. Hasegawa, July, 1923; Gesseiji, 2♂ in alcohol, T. Kurisue and S. Maruta, July, 1923; Mt. Kongo, about 100 specimens in alcohol, T. Kurisue, M. Ochi and H. Okamoto, July to August, 1924.

This is an unrecorded species from Corea, previously known to occur only on the Amur.

6. **Panorpa coreana** n. sp.

(Pl. IV, fig. 5, Pl. V, figs. 1,2)

Head black, shining rostrum ochreous-brown, in the female with a longitudinal blackish streak; maxillary palpi yellowish-brown, lst., 2nd. and the apex of the apical joint black. Antennae black, lst. joint ochreouswn. wn. Prothorax black. Meso-and metathorax ochreous-brown with blackish-brown posterior margins, praescutum of the former blackish-brown; in the female scutum of mesonotum with a large blackish-brown spot, praescutum of metathorax with two small blackish-brown spots and scutum with a some-

what large blackish-brown spot. Abdomen ochreous-brown, Ist. to 3rd. notums blackish-brown; in the male a narrow black streak along the hind margin of 6th., 7th. and 8th. segments; in the female 9th., 10th. and the forked appendage of 10th., black. Hind margin of 3rd. abdominal segment in the male produced in the middle above into a raised, club-shaped prolongation, its tip resting upon a sharply pointed elevation on the 4th. segment. 6th. segment short, a little longer than 5th.; 7th. and 8th. of almost equal length, not stout and not so long, and not longer than one and one-half times that of the 6th., cylindrical. Branches of lower appendage very long and stout, its tip curved inwards. Upper appendage narrow, very long, its apical part turned up between the appendages of the cheliferous segments, the apex of which are shallowly and nallowly incised. The branches of the cheliferous segments very long and slender. Titillators visible. Subgenital plates in the female blackish, wedge-shaped and densely haired. Legs yellow to light yellowish-brown; Ist. joint and the tip of 2nd. to 5th. tarsal joints blackish. Claws serrate. Wings with rounded tips, and slightly yellowish tinged. Venation yellowish-brown, in the markings blackish. Markings black. A small spot (Bsp) near base of forewing; another that is larger, touching the hind margin (wanting in the hind wings); submedian band (Smb) indicated by two spots; marginal spot (Msp) large, bent inwards (very small in the hind wings); pterostigmatical band (ptb) broad and not forked, but its apical branch present; apical band (Ab) very broad.

Fore wing: 16 (♂) to 17 (♀) mm.
Hind wing: 14 (♂) to 15 (♀) mm.

Loc.: Shakuôji near Gensan; Kôryo near Keijo (1♂, 3♀ in alcohol, Y. Hasegawa, June, 1923).

Type: A single male and three female specimens in alcohol in my collection, captured by my assistant, Y. Hasegawa, on Aug. 7th., 1921.

At first sight the species looks like *Panorpa orientalis* and *panorpa approximata*, both of which occur in Corea, but the peculiar shape of the 9th. abdominal segment in the male and the color of the body easily

serves to separate these species.

7. Panorpa kongosana n. sp.

(pl. IV, fig. 8, pl. V, figs. 5,6)

Head shining black; rostrum dark brown; maxillary palpi yellowish-brown, the tip of the apical joint blackish-brown. Antennae blackish-brown, lst. joint ochraceous. Thorax yellow, pronotum blackish-brown, meso and metanotum blackish-brown, with a broad longitudinal yellow band. Legs yellowish, the tip of each tarsal joint brown. Claws serrate. Abdomen yellowish, 2nd. and 3rd. dosal segments of the male blackish-brown, while lst. to 9th. dosal segments of the female blackish-brown, and forked appendage of 10th. segment of the female black. Hind border of 3rd. abdominal segment in the male produced in the middle above into a short and broad lobe. On the 4th. dosal segment a black and sharp pointed tooth, which is bent anteriorly. 6th. segment cylindrical, 7th. cylindrical, thinner than the 6th. and a little longer, 8th. of almost equal length to the 6th. Upper appendage long and broad, its tip rounded. Lower appendage long and narrow, its branches slender, flattened and almost parallel. The branches of the cheliferous segments (*Pedes genitalis*) very long and slender. Wings narrow, with rounded apex, strongly tinged with yellow and with blackish markings. Venation yellowish-brown, in the markings blackish; cross veins in the apical half of wings whitish and hardly visible. Pterostigma whitish. Subcosta in the forewing extends to the costal margin scarcely beyond its middle. Submedian band (Smb) very broad, not extending to the fore margin; marginal spot (Msp) long and narrow; pterostigmatical band (Ptb) well defined, in the middle narrowed, and not forked but its apical branch present; apical band (Ab) narrow; on the area between pterostigmatical and apical bands two narrow bands; no spots in the basal part of the wing. Markings of the female closely resemble those of the male, but differ as follows: On the middle of anal cell a large spot; submedian band connected with marginal spot, usually only in the forewing; pterostigmatical band forked.

Fore wing: 11 (♂) — 12 (♀) mm.

Hind wing: 10 (♂) — 11 (♀) mm.

Loc.: Mt. Kongo.

Types: Two male and two female specimens in alcohol in my collection, collected by T. Kurisue, M. Ochi and the author, on July 27th., 1924.

This species resembles *Panorpa multifasciaria* Miyaké, which occurs in Japan proper, but differs from it in the shape of the upper and lower appendages of the 9th. segment.

8. Panorpodes komaensis n. sp.

(Pl. IV, figs. 3, 4, Pl. V, figs. 3, 4)

Head and rostrum ochraceous, maxillary palpi yellow, the tip of the apical joint brown. On vertex a shining black spot enclosing ocelli, four long and strong black hairs between the ocelli. Antennae blackish-brown, 1st. segment ochraceous. Lateral margins of rostrum with a strong dent in its first third and gradually narrowing towards the apex. Thorax ochraceous. Pronotum with ten long and strong black hairs, of which six are on the foremargin of praescutum and four on postscutellum; mesonotum with six similor hairs, of which four are on scutum and two on the scutellum. Abdomen ochraceous, on the sides (from 1st. to 6th. segments) white, 2nd. to 5th. dosal segments with a longitudinal brown band on the side. Legs yellow, the tips of tibiae brown, and of tarsal joints blackish. Wings pale ochraceous with elliptical apex. Longitudinal veins yellowish-brown, cross-veins on the apieal part of wings white and hardly visible. Pterostigma ochraceous. In the forewings *Sc* extends into the pterostigmatical area. Membrane of the female with dark brown markings. A small marginal spot (Msp) hardly visible, in the hindwing a little larger spot touching the hind margin of the peterostigmatical area; and apical band (Ab) very broad, with a large, hyaline spot. In the male as a rule no markings, though a trace of markings as in the female may sometimes be visible. Lower appendage of the male very broad, extending over the base of the cheliferous segments, it is cleft in its apical fourth;

the branches are flattened, their apices pointed and their inner sides near the apex with 6 to 7 black teeth. Upper appendage broad, its apex slightly emarginate.

	♂	♀
Fore wing:	12 — 14 mm.	13 — 15 mm.
Hind wing:	10 — 12 mm.	12 — 14 mm.

Loc.: Gesseiji, 10 ♂ and 5 ♀ in alcohol, T. Kurisue and S. Maruta, early July, 1923; Mt. Kongo, 2 ♂ and 5 ♀ in alcohol, H. Okamoto, T. Kurisue and M. Ochi, July to August, 1924; Mt. Chii, 4 ♂ in alcohol, Y. Hasegawa and S. Maruta, August, 1924.

This species is closely alied *Panorpodes paradox* M'L., which occurs only in Japan proper, but differs from it in the peculiar shape of the lower appendage of the 9th. abdominal segment of the male.

It is the first species of this genus, found to occur in Corea, and seems to be common.

9. Bittacus mastrillii Navás

Bittacus mastrillii Nav., Bull. Mus. d'Hist. nat. Paris, p. 443 (1913); Esb.-Peters., Coll. Zool. Edm. de Selys Longc., Fasc. 5, Mecoptera, p. 123, figs. 134, 135 (1921).

Loc.: Kôryo, 1♂, C. Inouye, Aug., 1919; Suigen, 1♂, 1♀ in alcohol, H. Okamoto, June, 1922; Kwasan near Suigen, 1 ♂ in alcohol, Y. Hasegawa, June, 1922; Japan (according to Navás and Esben-Petersen).

Common in the middle part of Corea, but it seems to be very rare in Japan proper.

10. Bittacus sinensis Walker

Bittacus sinensis Walker, Cat. Neur. Ins. Brit. Mus., p. 469 (1853); Mac Lachlan, Mitt. Schweiz. Ent. Ges., p. 406 (1887); Miyaké, Journ. Coll. Agr. Imp. Univ. Tokyo, IV, p. 386 (1913); Esb.-Peters., Coll. Zool. Edm. de Selys Longc., Fasc. 5, Mecoptera, p. 121, figs. 132, 133 (1921).

Diplostigma sinensis Navás, Mem. Real. Acad. Cienc. Art. Barcerona, p. 413 (1908); Id., Revue Russe d'Entom., p. 277 (1909).

Bittacus quatcrnipunctatus Enderlein, Zool. Anz., p. 397 (1910); Miyaké,

ibid., p. 387, Pl. 33, fig. 6; Pl. 37, fig. 10 (1913).

Bittacus strategus Navás, Bull. Mus. d'Hist. nat., Paris, p. 442, figs. 2a, 2b (1913).

Loc.: Suigen, 1♀, 5♂ in alcohol, Y. Hasegawa, June to July, 1922; Shakuôji, 1 ♀ in alcohol, T. Kurisue, July, 1922.

Common in Corea and Japan proper.

EXPLANATION OF PLATES.

PLATE IV.

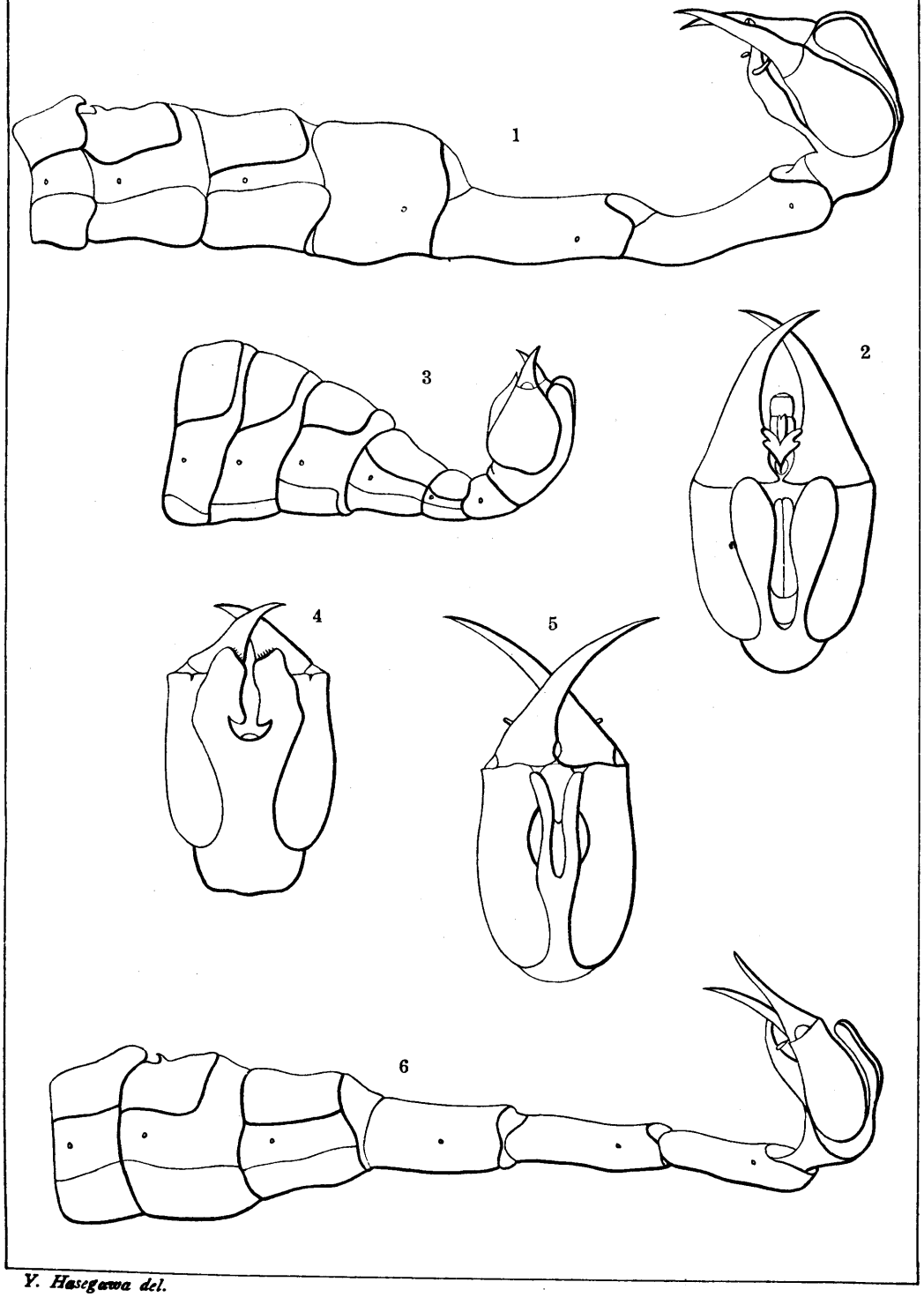
Fig. 1.	*Panorpa sibirica* Petersen.	Wings of male	× 20
Fig. 2.	*Panorpa amurensis* Mac Lachlan.	Wings of male	× 20
Fig. 3.	*Panorpodes komaensis* n. sp.	Wirgs of male	× 21
Fig. 4.	*Ditto.*	Wings of female	× 18
Fig. 5.	*Panorpa coreana* n. sp.	Wings of male	× 15
Fig. 6.	*Panorpa orientalis* Mac Lachlan.	Wings of male	× 20
Fig. 7.	*Panorpa cornigera* Mac Lachlan.	Wings of male	× 20
Fig. 8.	*Panorpa kongosana* n. sp.	Wings of male	× 26

PLATE V.

Fig. 1.	*Panorpa coreana* n. sp. ♀.	Lateral view of abdominal segments.
Fig. 2.	*Ditto.*	Ventral view of terminal segment.
Fig. 3.	*Panorpodes komaensis* n. sp. ♀.	Lateral view of abdominal segments.
Fig. 4.	*Ditto.*	Ventral view of terminal segment.
Fig. 5.	*Panorpa kongosana* n. sp. ♀.	Ventral view of terminal segment.
Fig. 6.	*Ditto.*	Lateral view of abdominal segments.

(Figures much enlarged)

S. Muramatsu Phot.



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