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INDIAN MUSEUM NOTES.

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EDITED BY THE OFFG. SUPERINTENDENT.

VOLUME VI.—NO. 1.

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The parts of the serial are published from time to time as materials accumulate. Communications are invited; they should be addressed to—*The Editor, Indian Museum Notes, Calcutta,* and should be accompanied by specimens of the insects to which reference is made. Soft-bodied insects can be sent in strong spirit; chrysalids and cocoons alive, and packed lightly in leaves or grass; other insects, dried and pinned, or wrapped in soft paper. Live insects should be sent when there is a reasonable chance of their surviving the journey. Caterpillars, grubs, and other immature insects can, in the present state of our knowledge, be only approximately determined; they should therefore, where possible, be accompanied by specimens of the mature insects into which they transform.

CONTENTS.

ORIGINAL COMMUNICATIONS.

PAGE.

1. Description of a new species of *Oligotrophus* from India, by D. W. Coquillett 1
2. Descriptions of three new Parasitic Hymenoptera from India, by W. H. Ashmead, M.A. 2
3. Description of a new *Serica* destructive to *Mallotus philippinensis*, by Ernst Brenske 4
4. Notes on *Helopeltis theivora*, the 'Mosquito Blight' of Tea, by Harold H. Mann, M.Sc. 5
5. Insecta Indica I.—Coleoptera 1 14
   Notes on the *Bostrichidæ* of the Indian Region, Part I, by the Editor.
6. A preliminary Report on two serious pests of the Indigo Plant by H. W. Peal, Assistant Entomologist, Indian Museum . . . 43
7. Insecta Indica II.—Coleoptera 2 47
   A note upon some predaceous Coccinellidæ of the Indian Region, Part I, by the Editor.

NOTES ON INSECT PESTS FROM THE ENTOMOLOGICAL SECTION, INDIAN MUSEUM.

I.—Insect Pests of Fruit Trees 63
II.—Insect Pests of Plants 75
III.—Insect Pests of Vegetables 76
IV.—Insects affecting Cereals and Crops 78
V.—Insect Pests of Sugar Cane 82
VI.—Insects affecting Cotton 82
VII.—Insect Pests of Tea 84
VIII.—Insects affecting Fabrics 85
A Ceylon Pest 87
Economic Entomology in Ceylon 88

PREFACE.

WITH this number the Indian Museum Notes commence a sixth volume, a volume which the Editor trusts will find that ready support which has been so pleasing a feature and has proved so effective in the past, both in the Economic and Scientific branches of the subject. That such help has been abundantly forthcoming the five volumes already issued bear witness to, and our sincere thanks are due to all those whose active help and sympathy made their compilation possible.

In the future we look forward to a still greater progress. With Scientific Entomologists at work in the country many new species are likely to be discovered, entailing a large amount of descriptive work; many new life-histories will be worked out and new remedies for combating serious attacks devised; the relations and the work of parasitic insects, the introduction of pests from abroad and the spread of pests within the limits of the Continent will all receive attention, and records of the enquiries made will doubtless find their way into the Notes.

The Offg. Superintendent, who has edited the present number, has under preparation a conspectus giving a list of the insects and summarizing the whole of the information which has appeared about them in the previous five volumes. He trusts to be able to issue this conspectus in the present volume and believes it will be found as useful to those who make use of the Notes for working purposes as he has found it himself.

E. P. STEBBING, I.F.S.,
Offg. Superintendent, Nat. Hist. Section,
Indian Museum.

October 1903.

ORIGINAL COMMUNICATIONS.

1.—DESCRIPTION OF A NEW SPECIES OF *OLIGOTROPHUS* FROM INDIA.

By D. W. Coquillett.

(*Vide* Vol. V, No. 3, p. 115.)

Oligotrophus saligneus, n. sp.

Dark brown, the head except lower part of face, mesonotum and metanotum black, legs and halteres pale yellow, a pale yellow humeral spot, and a larger one beneath each wing; antennæ of male about half as long as the body, nineteen-jointed (2+17), the third joint consisting of a thickened basal part about one-half longer than broad and a constricted apical portion about half as long as the thickened basal part, the latter bearing two whorls of bristly hairs; remaining joints similar but becoming successively shorter, and with the constricted portion proportionately longer except between the last two segments which is extremely short; antennæ of female about one-third as long as the body, nineteen-jointed, the third joint slightly longer than broad, the following joints becoming successively shorter and narrower, wings grayish-hyaline, costal cell brownish, third vein (the apparent second) ending slightly above the extreme wing-tip, forming an apparent continuation of the small cross-vein, the latter issuing from the extreme base of the fifth vein (the apparent third); length, 1·5 to 2 mm. Two males and three females, bred May 4, 1901, from galls[1] on *Salix elegans* by (the late) Mr. Lionel de Nicévelle.

Habitat: Tehri Garhwal, North-Western Himalayas. Elevation 9,000 feet.

Gall formed on the stems or branches, sometimes affecting only one side of the stem or branch, at other times extending wholly around it, the smaller galls measuring from 7 to 16 mm. long, the larger ones 70 mm. long by 20 wide; outwardly the galls are bare, and present a somewhat blistered appearance.

[1] These galls were sent to the Indian Museum, Calcutta, from the Himalayas. The insects were bred out in the Museum.—*Ed.*

2.—DESCRIPTIONS OF THREE NEW PARASITIC HYMENOPTERA FROM INDIA.

By William H. Ashmead, M.A.,

Assistant Curator,

United States National Museum.

The following three species of parasitic Hymenoptera were received by Dr. L. O. Howard, Entomologist of the United States Department of Agriculture, from (the late) Mr. Lionel de Nicéville, Entomologist to the Indian Museum, Calcutta.

FAMILY, *Bethylidæ.*

(*Vide* Vol. V, No. 3, pp. 178 and 181.)

1. Goniozus indicus, sp. nov.

♀.—Length 2·5 to 3 mm. Black and shining, the head with some small, sparse, scattered punctures, the pronotum very delicately and microscopically shagreened, the parapsidal furrows not indicated, the metathorax feebly reticulate with irregular microscopic lines at the sides, the antennæ and the legs, except the coxæ, anterior femora *above* and the middle and hind femora except at tips, honey-yellow, the anterior femora *above* and the middle and hind femora being embrowned or black; the extreme apex of the dorsal abdominal segments 2 to 4 are usually more or less jointly testaceous, while the wings are hyaline, the veins more or less yellowish, the stigma and parastigma being brown.

Type.—Cat. No. 6140, U. S. N. M.

Host.—Lepid., larva of *Scirpophaga auriflua*, a Crambid sugar-cane borer.

Described from several specimens bred by Mr. de Nicévelle. This species comes very close to *G. tibialis*, Voll., the only other described Asiatic species, but it is easily distinguished from it by the colour of the antennæ and legs, the absence of parapsidal furrows and by its sculpture.

2. Apanteles scirpophagae, sp. nov.

♂.—Length 1·9 mm. Black and shining, pubescent, the mesonotum with some sparse punctures, the scutellum with a crenate

furrow across the base, the metathorax opaque, wrinkled, the first and second dorsal abdominal segments sculptured, the following segments smooth, impunctate; the scape and legs, including the coxæ, are honey-yellow, the flagellum being brown-black and pubescent. Wings hyaline, the costa and stigma, except a large pale blotch basally and within, are brownish, while the rest of the veins are pale yellowish or whitish.

TYPE.—Cat. No. 6141, U. S. N. M.

HOST.—Lepid., *Scirpophaga auriflua.*

Described from one ♂ specimen. Comes apparently nearest to *Apanteles monagriæ*, Olliff., described from Australia.

3. Macrocentrus Nicévillei, sp. nov.

♀.—Length, 2 to 2·5 mm.; ovipositor longer than the whole insect. Uniformly pale yellow except the eyes, which are brown-black with purplish reflections in certain lights and a black or brown spot enclosing the pale ocelli. The long antennæ are faintly dusky towards their tips. The wings are hyaline and iridescent, the stigma and veins yellowish, the costal vein and the outer edge of the stigma being brownish, the second cubital cell being narrowed towards apex, the second transverse cubitus being only about half as long as the first.

♂.—Differs from ♀ only in having the flagellum and the apical half of the abdomen brown, the latter being depressed and without the prominent ovipositor.

TYPE.—Cat. No. 6142, U. S. N. M.

HOST.—Lepid., *Nonagria inferens*, Wlk., a sugar-cane-borer.

Described from many specimens, bred by (the late) Mr. de Nicéville from the host taken in Champaran, Behar.

Mr. Ashmead makes the following note upon these species:—

Goniozus indicus, Ashm. There is only one other species described from Asia by Vollenhoven.

Apanteles scirpophagæ, Ashm. No other species is known from India, and it is represented by a single specimen. I have kept this and a good series of the other species mentioned for the National Museum.

Macrocentrus nicévillei, Ashm. It is the first species in the genus to be described from Asia.

3.—DESCRIPTION OF A NEW SERICA DESTRUCTIVE TO MALLOTUS PHILIPPINENSIS.

By Ernst Brenske.

Serica Alcocki n. sp.

Long. 6, 5—f ; Lat. 3, 5—4 mill. ♂ ♀

Patria:—Siwalik Hills, Dehra Dun (Indian Mus., Calcutta).

Opaca, brunnea supra nigrescens, pruinosa; clypeo rotundato, antice parum sinuato margine elevato, dense ac leviter rugulaso, punctato, subtiliter carinato, haud spinoso. Prothorace convexo, lateribus rotundatis, antice medio parum producto; angulis posticis late rotundatis. Scutello parvo, haud lato. Elytris subtiliter striatis, striis irregulariter punctatis, interstitiis planis, fere inpunctatis. Femoribus dilatatis, haud spinosis; tibiis posticis parum dilatatis, anticis acute bidentatis. Antennis gracilibus, decemarticulatis, clava triphylla, parva. Articulo ultimo palporum maxillarum breviter ovato, acuto.

This insect is alluded to on p. 217 of volume IV of these Notes.

By some unaccountable oversight, due most probably to the letter getting mislaid on the death of Mr. Barlow, the description has not previously appeared. Our sincere apologies are due to Herr Brenske for this regrettable delay.

4.—NOTES ON HELOPELTIS THEIVORA, THE "MOSQUITO BLIGHT" OF TEA.

By Harold H. Mann, M.Sc.

The recent progress which has been made in the methods of attempting to deal with *Helopeltis theivora*, which is by far the most serious insect pest of tea, justifies a description of these methods, the principles on which they are based, and the results which appear to have been achieved. Before doing so, it will be as well to indicate some points in the life-history which have recently been made out, and to describe the insect, as it occurs in Cachar, more minutely than has hitherto been done.

We owe almost all our morphological descriptions of this capsid bug to Mr. Waterhouse, who named it; to Mr. S. E. Peal and to Mr. Dudgeon, who alone have attempted to describe it accurately. Mr. Dudgeon's description of the adult mature insect is in fact one to which there is, except in matters of detail, little to add, at any rate as concerns the type which is almost exclusively found in the Darjeeling Terai, the Duars, Cachar, and Sylhet. Mr. Waterhouse's description was, however, as follows.

♀ Black; pronotum orange yellow, with a black line near the anterior margin, the base margined with black; scutellum brown, black at the base, spine or horn long, much curved, black, at the apex brown: antennæ dark brown, basal joint paler, yellow at the base: femora dark brown mottled with light brown, with a light yellow ring at the base: tibiæ light brown, speckled with dark brown.

On this Mr. Dudgeon remarks: "the female insect only is described: presumably, therefore, the insect figured to illustrate the description* is also a female: the ovipositor is not shown, however, although it is more than half as long as the rostrum. It is difficult to distinguish it on the underside of the abdomen, folded, as it is, close against the dark shiny surface with which it matches well in colour: but, if the body be pressed, it rises from the surface and can be distinctly seen with the naked eye. It is in the form of a curved corneous process, rising from the centre of the sixth abdominal segment on the underside and reaching to the eighth segment. Its colour, like that of the posterior abdominal segments, is dark brown.†

* In Indian Economic Entomology, Vol. I., No. 4.

† Though a considerably redder brown than these segments (H. H. M.).

Owing to the position of the egg when laid, it will be seen that an ovipositor of this or similar form is necessary. ..... Nine or ten eggs are generally found in the body of a mature female, as, owing to their large size in comparison to the insect itself, there would scarcely be room for more. It is possible that more eggs are formed as they are laid."

"It will be seen by referring to Mr. Waterhouse's description of the insect that no mention is made of the colour or markings of the abdomen ..... The abdomen in fresh specimens of both sexes is invariably bright emerald green by transparency, marked dorsally on the third to the ninth segments with shiny dark brown. The extent of brown on the third segment is limited to a small dorsal patch or is altogether absent; on the fourth it extends over the whole dorsal region: on the fifth partially lateral and wholly dorsal: the remaining segments are all dark brown: the segmental divisions are greenish. The male differs from the female in having the pronotum very slightly tinged with yellow: the abdomen more slender and the absence of the ovipositor. The larvæ are greenish with deep ochreous or orange legs and antennæ: in some the abdomen is distinctly yellowish, although the same becomes green after having fed."

With the exception of the last sentence this description agrees in every particular with the insect as found in the districts above named. I have, however, never been able to detect any change in colour of the larvæ. From their earliest development to their last moult the colour of the larvæ varies from an orange brown to a bright emerald green, a difference for which one cannot at present account.

To this description one can, however, add further details as to the form and venation of the wings, as to the form of the tarsus and leg as to the structure of the scutellar horn, as to the formation of the rostrum and as to the form of the ovipositor and the anus of the female. All of these are illustrated in Plates I and II, the figures being directly drawn from preparations made from Cachar insects hardened in alcohol.

Wings.—The hemelytron is long and rather drumstick-like in shape averaging in length 6·4 mm. The clavus is well developed but triangular in shape being widest at the root of the wing. The corium is not hard, being little thicker than the remaining part of the wing. It passes into the cuneus without any division. The membrane has only one vein irregularly shaped as shown in the figure. The wing membrane (*see* fig. 3, Plate I) is covered with very microscopic hairs, and the edge is, as shown, very distinctly hairy. The hind

wing has no very peculiar features. It is about 5·3 mm. long and possesses, however, one spur-like vein in the membrane of the wing.

Leg and Tarsus.—The hind leg is figured in Plate I, figs. 5 and 6, and the tarsus separately (fig. 7) at a higher magnification. This is in general, just as described by Mr. Waterhouse, "the femora dark brown mottled with light brown: the tibiæ light brown speckled with dark brown." The lower part of the tibia is very hairy. The tarsus is ·56 mm. in length and is composed of three joints; of these the first is very large and hairy and overlaps considerably the second joint, which is small, not being half the size of the first joint. The third is intermediate in size, and like the other two very hairy. The last joint bears two claws on each side of the tarsus. The femora is about 2·6 mm. and the tibia 3·5 mm. in length.

Scutellar horn.—This, which is the peculiarity of the genus *Helopeltis*, rises from the central segment of the thorax to a height of 1·3 mm. It is bent backwards, though not nearly so much as would be imagined from Mr. Waterhouse's description. It contains no duct of any sort. The tip is a cup (see Plate I, figs. 8, 9, and Pl. II, fig. 10), shown highly magnified in fig. 10, and less so in fig. 8, which contains a multitude of short hairs. There seems a good deal to show that this is in some way a sense organ, but this point needs further observation.

Rostrum.—(Plate II, figs. 2, 3, 4, 5, and 6).—The rostrum is four-jointed, and is usually held parallel to the body, and underneath it. It is 2 mm. in length. It contains, as is usual with this group, four setæ, which are shown in fig. 2, and one of which is shown extracted in fig. 3. The rostrum is slightly hairy throughout its length. The tip shown enlarged in fig. 4, and highly magnified (front and side view) in figs. 5 and 6, is very hairy and can evidently be used as a suction bell.

Ovipositor.—The description of the ovipositor by Dudgeon above quoted is complete except that he did not mention that it is double. In all cases I have examined it is formed of two separate instruments, quite serrated on one side of the tip, apparently to act as a means of lacerating the stalk of the plant. Its length in the mature insect is about 1·5 mm.

Anus of the female.—This is depicted in Plate II, figs. 9 and 10—and possesses no features of importance. The orifice itself is about ·3 mm. in diameter.

The description of these features will probably be of some importance in the classification of the species of this genus, which has, not as yet been satisfactorily carried out.

The life-history has now been fairly well ascertained, and, as occurring under normal conditions, does not require a fresh description here. I have gone fully into the matter recently in conjunction with Sir George Watt (*The Pests and Blights of the Tea Plant:* Calcutta, Government of India Press, 1903). There are several points, however, which are still obscure, and it is with the object of trying to throw some light on one or two of these that these notes are written.

The number of eggs laid by one female has never been determined, nor is it known whether new eggs continue to be produced after the maturity and fertilisation of the insect by the male. The only attempts to touch on this point have been those of Mr. Green,* but he confined himself to showing by dissection that the individual female contained more eggs in that period of the year when the insect was not destructively active. It struck me, however, that valuable information might be obtained by examining female adults caught late in the afternoon. It is, of course, probable that the eggs are either laid chiefly at night or else in the daytime, and hence if eggs are continuously being produced in the body there ought to be a great excess of eggs in the females either in the morning or in the evening. In November 1902 a large number of insects were therefore dissected, and some of the results follow. In each case the female was dissected out in order to show the eggs, which were then carefully counted.

1. *Kuttal*, Cachar, October 27, 1902.—

   (*a*) *Morning Catch*—24 adult insects; 6 females. Females contained respectively (1) 17, (2) 20, (3) 15, (4) 6 eggs. Average 14½ eggs per insect.

   (*b*) *Afternoon Catch*—35 adult insects; 16 females. Females contained respectively (1) 4, (2) 0, (3) 4, (4) 0, (5) 10, (6) 14, (7) 0, (8) 0, (9) 11, (10) 0, (11) 13, (12) 0, (13) 20 eggs. Average 5·8 eggs per insect, while 46 per cent. contain none at all.

2. *Kuttal*, Cachar, October 28th, 1902 :—

   (*a*) One insect caught 8 A.M., contained 14 eggs.

3. *Silcoorie*, Cachar, October 30th, 1902 :—

   (*a*) *Morning Catch*—220 adult insects; 103 females. Six females, selected at random, contained respectively (1) 1, (2) 16, (3) 18, (4) 19, (5) 0, (6) 10 eggs. Average 10·4 eggs per insect; 16·7 per cent. contain none at all.

* Circular, Royal Botanic Gardens, Peradeniya, Series I, No. 21, 1902.

(*b*) *Afternoon Catch*—equal number males and females. Four females, selected at random, contained respectively (1) 0, (2) 18, (3) 0, (4) 23 eggs. Average 10·12 eggs per insect; 50 per cent. contain none at all.

4. *Chandighat,* Cachar, November 12th, 1902:—

(*a*) *Morning Catch*—19 adult insects; 5 females. Females contained respectively (1) 14, (2) 9, (3) 12, (4) 13, (5) 8 eggs. Average 11·2 eggs per insect; none were without eggs.

5. *Doloo,* Cachar, November 14th, 1902:—

(*a*) *Catch in middle of day, under shade*—154 adult insects; 72 females. Eight females, selected at random, contained respectively (1) 0, (2) 6, (3) 14, (4) 0, (5) 0, (6) 0, (7) 0, (8) 7 eggs. Average 3·4 eggs per insect; 62·5 per cent. contained none at all.

Such are the figures obtained. On the face they seem rather self-contradictory, especially as the largest number of all was found in an insect caught in the afternoon, but, nevertheless, on the whole these figures seem most clearly to indicate that the insects contain more eggs in the morning than in the afternoon; that is to say, that *then* they have not exhausted their supply, as they have done later in the day. Now when to this is added the fact that in the ovary of the female insect one frequently comes across a few of what are apparently eggs in course of formation, but very difficult to dissect out, I think one will have to conclude that the evidence is strongly in favour of the inference that eggs are to a certain extent continuously formed in the body of the mature female, and that instead of laying a definite number of eggs and then dying, as is usual in, say, the Lepidoptera, the insect, in a certain measure, *continuously* produces eggs after arriving at maturity. The few insects containing a large number of eggs found late in the afternoon, are probably those which have recently arrived at maturity and have hardly, if at all, commenced egg-laying.

Hibernation of the insect.—It has been noticed ever since the first appearance of the tea mosquito as a pest of Cocoa, Cinchona and Tea that at certain times of the year it disappeared, or appeared to do so. In the Indian districts, for instance, this time runs from the middle of December till March or April; in Ceylon there are two periods when the *Helopeltis antonii* of their districts can hardly be found. The question at once arises as to whether this is a real hibernation or no; does the insect become quite inactive, or is it merely reduced in numbers; does it spend this time in one condition or does it continue to breed?

Some time ago* I showed that the supposed fact of the disappearance was not real, and that the insect could be found on the bushes in all stages at any part of the year, provided sufficient care were taken in seeking them. I also showed that living eggs were present in the bushes in January when the insect was supposed to be in full hibernation. During the past hibernating season I have been able, with the aid of Mr. J. J. Smith of the Behalli Tea Estate, Assam, to follow the life of the insects throughout the hibernating period. On nearly every day since December 25, 1902, to the end of April, boys have been employed catching the insects, a task, at which, though it is of extreme difficulty to a beginner, they become very expert. More than this, every day's catch has been sorted out into males, females, and larvæ. The results summarised are as follows:—

Date.	Adult Males.	Adult Females.	Larvæ.	Total Insects.	Remarks.
December (25 to 31)	10	19	60	89	4 boys employed catching.
January (20 days)	20	27	448	495	3 to 6 boys employed.
February (25 days)	48	40	1,084	1,172	4 to 15 children employed.
March (23 days)	60	101	1,550	1,711	10 to 19 children employed.
April (26 days)	25	81	1,069	1,175	18 to 21 children employed.

The above plots were sprayed with kerosene emulsion (see below) in January, February, and March. On another garden, close to the above, where the place had been partly, but only partly, sprayed with Chiswick Compound the following figures were obtained in March and April:—

Date.	Adult Males.	Adult Females.	Larvæ.	Total Insects.	Remarks.
March (24 to 31)	23	92	714	829	7 to 13 children employed
April (26 days)	131	685	2,298	3,114	10 to 24 children employed.

* *See* The Mosquito Blight of Tea. Pamphlet published by the Indian Tea Association. Calcutta, 1902.

These figures, taken with those I have previously published (*loc. cit.*) for ever set at rest the question of the hibernation of the Helopeltis in the Indian Tea Districts. They are breeding throughout the year, though this breeding descends to a minimum in October and November in some districts, and later in others. That this breeding is continuous is still more clearly shown by the following table, calculated from the figures given above:—

	December.	January.	February.	March.	April.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Adult males . .	11	4	4	$3\frac{1}{2}$	2
Adult females . .	21	5	3	6	7
Larvæ . . .	68	91	93	$90\frac{1}{2}$	91
TOTAL .	100	100	100	100	100

Mr. G. C. Dudgeon has recently informed me that he has found the adult insects, like many other bugs, in a very inactive condition in the lower part of the tea bush during the so-called hibernating months at Ging, Darjeeling (5,000 ft.). They do not, however, become in the least inactive in the plains districts, as I have found myself in the Darjeeling Terai. Moreover, I am informed from Cachar that the insects are much more difficult to catch at this period, owing to their great activity.

The reduction in numbers during these months and the fact that this is also the time of pruning the tea bushes in India, has led me to a method which bids fair, from experiments so far conducted, to give reasonable prospect of being able to deal with this serious pest. It is well known that capsid bugs are with difficultly reached by any spray that we know,—and in any case, spraying during the season of great activity of this insect (the rainy season), would be impossible because (1) when one may have five inches of heavy rain, and more, any day, there is no spray known which will stay on the bushes, (2) the leaf being the crop desired, which is plucked every week, it would mean stopping the plucking and manufacture of tea for some time to the utter ruin of the remainder of that year's crop. Thus spraying at the season of activity was ruled out of court in the early part of the investigation.

It was further found that the suggestion to severely pluck the bush, so as to take off the eggs laid in the young shoots with the leaf

plucked, long ago made by Mr. Wood-Mason, has precisely the opposite effect to that desired, and rendered the bush more susceptible to further attack.*

The conclusion appeared to be that the likely means of dealing with the insect was one of prevention rather than of cure, and involved making the bushes after pruning into as unfavourable a condition as possible for laying eggs, for a long enough time to prevent the insects then in existence laying eggs on the tea at all, and at the same time by a process of suffocation preventing the eggs already in the bushes hatching out at all. It is obvious that for a fair test of such a method, when one has to deal with a flying insect, it was absolutely necessary to experiment on a plot of tea sufficiently isolated to prevent the entrance of outside sources of infection. This cannot usually be done, but fortunately there is a means of knowing fairly exactly the nature of the attack in the early season, that is to say, whether it is caused by freshly introduced insects, or by those bred in the bushes, by the position of the punctured leaves. The insects bred in the bushes almost always produce small punctures caused by the young insects in the interior of the bushes ; while the freshly introduced bugs produce in greater part large punctures chiefly caused by adult insects, *and are near the surface of the bush*. After the end of May this distinction does not really hold good to an extent which will enable the attack to be classified.

The materials tried up to the present in these experiments are (1) kerosene emulsion, made up according to the American formula and diluted to ten times its volume, though I usually, however, have to employ for the waters in the tea districts, 2 lbs. of soft soap per two gallons of kerosene to get a satisfactory emulsion easily; and (2) Chiswick compound, employed as recommended by the Chiswick Soap Company at the rate of 25 lbs. to two hundred gallons of water. A Gould's Standard Sprayer has been employed throughout.

In the experiments in 1902, the area treated was twelve acres quite isolated by being a 100 yards from any other tea. This distance, as had been already seen in May, was not, however, sufficient to prevent the introduction of insects from the nearest outside plots of tea. The tea was pruned two years back in February, but no cleaning out of the twiggy growth was attempted, as this is not usually done in the Terai where this experiment was carried out. The spraying was done with the kerosene emulsion in March, and with the Chiswick compound in April. In May I visited the garden and found that very few (2 per cent.) of the bushes on either of the treated plots were even touched with the pest, and, moreover, that

* Mr. Green, in Ceylon, has also noted this fact.

most of these had been attacked by insects which had flown in from outside. Both the Chiswick compound and the kerosene emulsion plots were equally free. The remainder of the garden, not treated, showed seventy-five per cent. of the bushes attacked.

At the end of July the manager wrote me that though the majority of the bushes showed signs of the pest, the bushes were still yielding leaf freely, while the other blocks near by were giving little or none. He added, moreover, "The bushes on the experimental block have quite vigorous growth, by comparison with the other blocks, and I am of opinion that they will be able to throw off the blight shortly."

The latter opinion was not quite justified, but at the end of the season, he was able to report that the bushes treated had yielded fully six weeks longer than the blocks unsprayed, and that one maund (eighty pounds) of tea had been obtained per acre in excess of what had been produced on similar plots elsewhere in the garden.

Favourable results like this have led to experiment on a much larger scale in 1903, when I have arranged to treat seventy-two acres in Assam, sixty-four acres in Cachar, and a hundred in the Darjeeling Terai. At present (May 1903) when the blight is only beginning to seriously appear it is impossible to draw any conclusions, but that the prospects of success are at present good is shown by letters received recently from all three places. Mr. J. J. Smith, who is in charge of the Assam experiments at the Behalli Tea Estate, writes on May 2: "I am very pleased with the look of the old tea sprayed at Bedetti, and should we have good rain soon, we ought to get good leaf returns."

Mr. H. E. Crawford of the Lalla Mookh Tea Estate, Cachar, writes under date April 28: "There are absolutely *no* leaves punctured by mosquito blight on the sprayed area, but a few are found on other parts of the garden. I think the treatment will at least check the mosquito blight very considerably; I mean that the pest will not put in an appearance as early as in former years."

In the Terai experiments Mr. Browne of the Longview Tea Estate, writes on May 7, 1903: "I have not seen so few signs of mosquito blight for many years, and am certain as soon as we get rain that the difference of the sprayed blocks and the unsprayed will be very quickly apparent."

Till the end of July it will be seen that no certain results can be given, but there is reasonable prospect, as stated above, that a method has been found by which the prevalence of this pest can be brought under control, if it cannot be entirely eradicated from tea estates.

5.—INSECTA INDICA I.

COLEOPTERA 1. Notes on the Bostrichidæ of the Indian Region, Part I.

By the Editor.

With the exception of the *Lepidoptera* and *Rhynchota*, a portion of the *Hymenoptera* and a family of the *Orthoptera* (the Mantodea), but little work has up to the present been undertaken in the direction of cataloguing or monographing the *Insecta* of the Indian Region. It is, therefore, extremely difficult for workers in the country to find out what is known about a family they may be interested in and equally so to discover (without going to the collections themselves which is generally impossible) to what extent that family is represented by specimens in the Indian Museum at Calcutta.

The work already accomplished on these lines may be roughly summarised. It consists of—

1. A series of papers on the Rhynchota of the Indian Region by the late Mr. E. T. Atkinson, I.C.S., read before the Asiatic Society and afterwards published in Part II of volumes LIII to LVII of the Journal. Species represented in the Indian Museum collections are noted.
2. Moore's Lepidoptera of Ceylon, 1880 to 1886.
3. A catalogue of the moths of India by E. C. Cotes, and Colonel Swinhoe commenced in 1887, completed in 1889. Published by the Trustees of the Indian Museum. Species in the Indian Museum collections are noted.
4. Catalogue of the Mantodea by Mr. J. Wood-Mason, Superintendent, Indian Museum. Two parts, 1889 and 1891. Published by the Trustees of the Indian Museum. Species in the Indian Museum collections are noted.
5. Butterflies of India by L. de Nicéville (3 volumes, 1882-1890). A fourth volume is complete in manuscript.* No notes have been made as to whether the species enumerated are represented in the Indian Museum collections, but as the Trustees of the Museum purchased the whole of Mr. de Nicévelle's valuable collection, it is probable that most of the species referred to are in the collections.
6. Moore's Lepidoptera Indica; commenced in 1891—64 Parts issued.

* This MS. has been purchased by the Trustees of the Indian Museum and sent to Colonel C. T. Bingham for incorporation in the Fauna volumes on the *Rhopalocera*.

7. The Moths of British India in the Fauna series by Sir G. Hampson, Bart., volumes I-IV, 1892–96.
8. The Hymenoptera Aculeata of British India in the Fauna series by Colonel C. T. Bingham, 2 volumes (1897 and 1903).
9. Rhynchota (Heteroptera) in the Fauna series, by Mr. W. L. Distant, 1 volume (1902).

No mention is made in the volumes of the Fauna series as to whether the species described are present in the Indian Museum collections or not.

10. A volume on the Longicornia is in preparation by Mr. C. J. Gahan of the British Museum and Colonel C. T. Bingham has taken in hand the Lepidoptera Rhopalocera—both for the Fauna series.

In addition to the above, papers on new species are of almost monthly appearance in one or other of the numerous scientific serials and magazines which record such. These cannot be listed here and few will be obtainable by the ordinary student in the country. I may mention, however, the continuation of the Fauna series (Moths) in the Journal of the Bombay Natural History Society which has also had some papers on Indian Hymenoptera and Rhopalocera, and the excellent papers on the Coccidæ of the Indian Region by Mr. Ernest Green in Indian Museum Notes.

It thus becomes evident that a vast amount of work in this direction remains to be undertaken. In these papers an attempt will be made to add something to what has already been so successfully commenced. It is not proposed to limit their scope to any one order, although it is probable that that much neglected one, the *Coleoptera*, will receive considerable attention. In the case of every insect mentioned, a reference will be made as to whether it is or is not represented in the Indian Museum. If it is not, every effort will be made to procure specimens of it for the collections. The papers are written with the intention of cataloguing the insects of the Indian Region, but short references will be given as to distribution, habits, etc., of the insects noticed.

On the Bostrichidæ of the Indian Region, Part I.

Until comparatively recently the family *Bostrichidæ* had been little studied. It was reserved for Mr. P. Lesne, of the Paris Natural History Museum, to take up and monograph this difficult but important group in his classical *Révision des Coleoptères de la famille des Bostrychides.** I have made use of this excellent memoir, or of the portions of it at present published, in revising the nomenclature of

*An. Soc. Ent. Fr. Vols. LXV, LXVI, LXVII, LXIX.

the members of the family present in the Indian Museum Collections and in drawing up the following notes on the *Bostrichidæ* of the Indian Region adding, where possible, any fresh information upon the life-histories, distribution, etc., that research and personal observations have brought to light and noting whether the species are represented in the Indian Museum collections or not. The family is of some economic importance, since it contains the well-known bamboo-borers which are widely distributed throughout the Indian Region.

The identification and separation of the species in the *Bostrichidæ* presents great difficulties. The uncertain limitations of the genera and the great scattering of original descriptions, often incomplete, has led to much confusion.

Mr. Lesne is entirely revising the classification of the whole group, and his revision has been followed in this paper. In the preparation of his valuable memoir, the distinguished scientist has had the advantage of consulting the materials contained in the collections of the Natural History Museums at Paris, Stockholm, and Brussels and the collections of MM. Leon, Faimaire, René Oberthür and Louis Bedel. Many other entomologists have also contributed notes and given every assistance. That the result is worthy of the Author a study of the memoir will at once make evident.

A perusal of the work has demonstrated the fact that this family is a little known one and has been but slightly collected in the Indian Region. Some 40 odd species in all represent the total at present known and the information about them is of the meagrest. There can hardly be any doubt, I think, that there are numbers of forms at present unknown to science scattered throughout the region.

Mr. Lesne divides the *Bostrichidæ* into the following four tribes, of which the first two are included in his *Bostrichidæ procephalæ*, the last two in the *Bostrichidæ hypocephalæ*.

TABLEAU DES TRIBUS.

1—Tête insérée à la face antérieure du prothorax, complétment visible en dessus. Pronotum légèrement convexe, inerme en avant . . . *Bostrichidæ procephalæ.* 2.

1*—Tête insérée à la face inférieure du prothorax, invisible en dessus. Pronotum très convexe, hérissé de denticules en avant . . . *Bostrichidæ hypocephalæ.* 3.

2—Hanches antérieures non séparées par le prosternum. Intermaxillaires[1] atrophié. Éperons terminaux internes des tibias anterieurs droits, égaux ou peu dissemblables. Coloration en partie metallique . . . Tribu *Psoinæ*

[1] The intermaxillary of the jaws is here alluded to.

2—Hanches antérieures séparées par un lobe prosternal. Intermaxillaire bien developpé. Éperons terminaux internes des tibias antérieurs très dissemblables, le plus grand fortement recourbé en arrière, le plus petit droit ou absent. Coloration brune . . . Tribu *Polycaoninæ*.

3—Tarses plus courts que les tibias; onychium[1] aussi long ou plus long que les articles précédents réunis. Hanches antérieures moins saillantes et nettement transverse. Pronotum regulièrement convexe, arrondi au bord antérieur les denticules médians étant les plus developpés. Vertex lisse on finement ponctúe . . Tribu *Dinoderinæ*.

3*.—Tarses aussi longs ou plus longs que les tibias; onychium plus court que les articles précédents réunis.[2] Hanches antérieures élevées, saillantes, subglobuleuses ou subconnoidës et non transverses. Pronotum fortement gibbeux, tronqué ou échancré au bord antérieur, les denticules lateraux etant plus développés que les medians.[3] Vertex couvert de petits granulés ou de très fines côtes longitudinales . . . . . Tribu *Bostrichinæ*.

Bostrichidæ Procephalæ.

The Tribe *Psoinæ* is at present unreported from India.

Tribe Polycaoninæ.

The tribe *Polycaoninæ* consists of two genera—*Polycaon* and *Heterarthron*—of which the former is as yet unreported from India.

Genus *Heterarthron*.

Guérin, 1884, Icon. du Règn. Anim. Ins., p. 186.
Exopioides Guérin, 1844, l.c., p. 187.—Id., 1845, Ann. Fr., Bull., p. XVII (sub *Exopsoides*).
Polycaon auct.

Body cylindrical. Anterior legs very robust, their tibiæ strongly indented on the inner sides at their bases and armed with a single minor terminal spur. Joints two and three of the tarsus prolonged on their inner lower edges, the joint below being inserted in the

[1] This is the name given by Mr. Lesne to the last tarsal joint.

[2] These characters of the tarsal joints of the *Bostrichinæ* are not absolutely constant.

[3] *Bostrichus elongatus*, Lesne, is the only one whose pronotum does not show these characters.

angle thus formed. Sides of the prothorax flat or slightly concave. Elytra very obtuse behind, ornamented with ribs, keels or teeth (except in *H. confertus* Lec.).

1. Heterarthron Feanus, Lesne.

Ann. Mus. Gen., Serie 2, Vol. XIX (XXXIX), 6 Maggio, 1899.

Long 11½—18 mill.

Long, dark brown. Top of the head densely granulated. Frontal clypeal suture nearly straight. Epistome toothed in the middle of its anterior edge. Antennæ 11-jointed. Labrum indented in front. Prothorax markedly constricted behind, narrower than the head (including the eyes) and than the elytra. Median groove of the pronotum strongly impressed at a point situated a little in front of the middle of the prothorax. Apical declivity of the elytra without restricting ridges or keels, and showing a few scattered granulations, its punctuation being extremely fine. The suture is ridged on the declivity.

♂. Top of the head with hardly any granulations. Clypeal tooth small, keeled. Basilar piece of head simple. Labium symmetrical, without apophysis at the left anterior angle. Pronotum densely granulated, except in its middle-anterior portion where it is finely punctured; granulations very scattered on the disc. Elytra slightly widened behind, shining in their dorsal area, strongly and rather densely punctuate near their base and showing laterally an oblique side (edge) where the punctuation is extremely fine and little dense, and where the tegument is dull. This dull area is limited behind on the inner side by a longitudinal very obtuse ridge, furnished itself on its inner side with a series of granulations. Sutural angle of the elytra toothed. Abdominal pubescence long and dense.

♀. Top of the head covered as is the pronotum with erect dense granulations. Median tooth of the epistome obtuse, not keeled. Eyes proportionately larger than in ♂. Pronotum densely granulated except in the middle of the anterior edge. Elytra nearly parallel, strongly punctuate on the back and sides, finely and densely rasp-like on the lateral edges. Apical angle of the elytra straight, pointed. Abdominal pubescence less dense than in the ♂.

This description is made from 5 individuals, 4 ♂ and 1 ♀. One of the ♂ is very small (11½ millim.; the length of the others varies between 17 and 18 millimetres.

Distribution.—Thagata, Tenasserim.

Unrepresented in *Coll. Ind. Mus. Calc.*

Life-History.—Little is known upon this subject. Mr. Lesne states that the discovery of a *Heterarthron* in the Old World is a most remarkable one, since all that was known about the *Polycaoninæ* pointed to their being of exclusively American origin. The species above described is a perfectly typical *Heterarthron*, but markedly distinct from the other known species. It is closely allied to the South American forms, *H. rufipes*, *H. gracileps* and *H. parvidens*, from which it chiefly differs in the absence of all bordering ridge or keel on the apical declivity of the elytra and by the simple labium of the male.

Mr. Lesne suggests that appearances are in favour of this species being a recently introduced one into Asia. Personally I am more inclined to the idea that research will not improbably bring to light further specimens in Burma and perhaps Southern Madras.

BOSTRICHIDÆ HYPOCEPHALÆ.

Tribe DINODERINÆ.

(See Tabl. des tribus 1*, 3.)

LESNE.—Ann. Soc. Ent. Fr. LXVI, 1897.

The tribe is divided into four genera—*Dinoderus*, *Rhizopertha*, *Stephanopachys*, and *Prostephanus*—of which representatives of only the former two appear to have been reported from the Indian region.

The following is the portion of Lesne's generic table referring to these two:—

TABLEAU DES GENRES.

1-4—Front indistinct on notablement plus court que l'épistome. Suture latérale prothoracique tonjours bien marquée en arrière.

2-3—Front indistinct. Deuxième article des antennes plus court que le premier. Dernier segment ventral apparent de l'abdomen présentant aubord postérieur une échancrure en arc de cercle où s'applique le bord postérieur du pygidium. Aire postérieure du pronotum ponctuée . . . G. *Dinoderus*, Steph.

3-2—Front distinct, de moitié plus court que l'épistome. Deuxième articledes antennes aussi long que le premier. Dernier segment ventral apparent de l'abdomen entier, arrondi au bord posterieur. Aire postèrieure du pronotum converte de granules écrasés . G. *Rhizopertha*, Steph.

The habits of *Dinoderus* and *Rhizopertha* would appear to be much the same. They live in and feed upon dead wood. Bamboos are severely attacked by several species of the former genus.

Genus ***Dinoderus,*** Stephens.

Stephens, 1830, Ill. Brit. Ent., III, p. 352.
Waterhouse, 1883, Ann. Nat. Hist., 1883, I, p. 348.
Zoufal, 1894, Wien. Ent. Zeit., XIII, p. 35.

Until 1888 the species of the Genus *Stephanopachys* were named ***Dinoderus.*** Mr. C. O. Waterhouse pointed out this mistake and formed the genus *Stephanopachys.*

1. ***Dinoderus distinctus,*** Lesne.

Lesne, Ann. Soc. Ent. Fr. Vol. LXVI, p. 325 (1897.)

Longish, brown with a slight reddish tint at the base of the elytra. Front of head and funiculus without long erect hairs. 10-jointed antennæ; second joint of club less than one and a half times as wide as long. Prothorax is rather shorter than in other *Dinoderus,* evenly rounded in front, widened near the base, its sides not parallel; the lateral suture joined in front with the marginal teeth of the rasp-like anterior surface, these teeth being small, almost contiguous, rounded, the two middle ones the largest. The posterior portion of the pronotum densely punctuate, especially in the middle, no trace of median foveoles being present. Scutellum flat, dull, rectangular, less than twice as wide as long. Elytra parallel, slightly widened behind, more than twice as long as the prothorax, elytral punctures deep, not distinctly ocellated, the punctures not coalescing in the dorsal region, less deep and coalescing on the posterior declivity. Suture not gaping in the declivity. The erect hairs on the elytra very short. Long $3\frac{1}{2}$ millim.

Distribution.—The Dehra Dun plateau, United Provinces. Elevation 2,000 feet (mihi). This is the first record of the insect existing in India.

Specimens present in—*Coll. Ind. Mus.; Coll. For. Ent., Govt. of Ind.; Coll.* mihi.

Life-History.—The beetle appears on the wing about the first week in May and oviposits in the smaller branches and twigs of the Mango (*Mangifera indica*) tree. It attacks only dying and dead wood. The beetles discovered were in pairs working together and they appeared to have entered the tree by the same entrance hole. This entrance tunnel is bored vertically down to the centre of the

branch and then the egg-gallery is taken up the twig approximately at right angles to the former direction. This latter gallery curves slightly. In the branches examined there were usually two beetles at work in this gallery. Several pairs of beetles will attack the same twig. In quite a small one three pairs were cut out on May 11th, 1902.

I have not yet ascertained how many generations in the year there are, nor how long the insect takes to pass through one generation.

2. *Dinoderus pilifrons*, Lesne.

Lesne, Ann. Soc, Ent. Fr., 1895, p. 170.
Dinoderus sp. Ind. Mus. Notes. Vols. I. IV. Steb. Injur. Ins. Ind. For. p. 42. Dep. Not. Ins. aff. For. No. 2, p. 168.

Long oblong, parallel, reddish brown, with the appendages and the lateral edges of the abdomen lighter-coloured. Antennæ 10-jointed; second joint of the club rounded on the inner edge; funiculus fringed with long light-red bristles. These latter also present on front clypeal region and on the inner margin of the eye. The marginal row of the rasp-like anterior portion of the prothorax contains 8-10 more or less pointed teeth, of which the two middle ones which are as large as the lateral ones are separated from one another. Punctuation of the posterior portion of the pronotum fine, rather dense, and not ocellated; median foveoles obsolete. Scutellum transverse. Punctuation of the elytra rather fine near the base, more marked, joined and areola-like on the posterior declivity where it is distinctly ocellated. The suture slightly gaping and half keel-shaped on the declivity.

Length $3\frac{1}{8}$ to $3\frac{3}{4}$ millim.

Larva.—Yellowish white, wrinkled, curved. Mouth parts brownish, mandibles black. Thoracic segments greatly enlarged swollen up forming almost a hood over head anteriorly. Three pairs of thoracic legs, anterior pair 3-jointed, robust and long; posterior pairs less stout. Abdominal segments not swollen, narrower than thoracic ones forming almost a waist where they join on to thorax but slightly broadening out behind. Length 3·2 millim.

Pupa.—Exhibits all the characteristics of a Bostrichid pupa. Prothorax large, the head being bent right over and under it, the mouth parts lying pressed against the hind thoracic and anterior abdominal segments. Head and prothorax dirty white; the 10-jointed antennæ and legs distinguishable. Abdominal segments yellow, wings white, bent round on to the underside of the body. Length 3 millim.

Distribution.—Reported from Dehra Dun; Siwaliks (mihi); Belgaon. Probably throughout India.

Specimens present in—*Coll. Ind. Mus.*, Dehra Dun (Oldham) Siwaliks and Dehra (mihi), Calcutta (mihi). Also in *Coll. For. Ent.* and *Coll. Steb.* from same localities.

Life-History.—This beetle attacks and breeds in sickly, dying and freshly cut bamboos. I have found it infesting *Dendrocalamus strictus* in large numbers. This bamboo grows in clumps in the Siwalik forests. Bamboos from these clumps were cut at the commencement of February and placed in a breeding box towards the end of March. In July the box was examined and found to be an inch deep in sawdust amongst which were enormous numbers of the *pilifrons* beetles. The bamboos were riddled with holes and galleries and larvæ were present in the latter. Many of the insects were left in the box with the bamboos up to November and during the whole of this period beetles were always to be found alive both in the bamboos and in the sawdust at the bottom.[1] It would thus seem evident that the insect has several generations in the year, and it is probable that these overlap. This experiment was made at Dehra in 1901. This year (1903) I found the beetles on April 25th flying over and setting upon and boring into the billets of a mixed wood stack at the Botanical Gardens, Calcutta. The beetles were ovipositing and I am of opinion that the eggs laid were those of the second generation of the year, since the 1901 experiments showed that eggs must have been laid in the bamboos cut at the beginning of February before the end of March, when they were shut up in the breeding box. Therefore it is probable that the April beetles are those of the first generation of the year matured from eggs laid in the bamboos during the latter part of February or in March.

The natives of India have many superstitions about this and the other bamboo-boring insects. The one most generally believed and which is now receiving careful study is that bamboos cut when the moon is full are more severely attacked by the *Dinoderus* than those cut at other periods. It is considered that bamboos cut when the sap is low in them are less liable to attack. The beetle undoubtedly causes serious loss in India. It is often to be found in large numbers in the bamboo superstructure of the thatch roofs so common in Indian bungalows.

3. Dinoderus punctatissimus.

Lesne, Ann. Soc. Ent. Fr. LXVI, 329 (1897).

Fairly long, parallel, reddish brown, with the appendages and at times the basal portion of the elytra lighter coloured. No long

[1] *Vide* Departl. Not. Ins. aff. For. No. 2, p. 168 (1903).

erect hairs upon the front clypeal region. Funiculus of antennæ not fringed with hair. Second article of the club about one and a half times as wide as long, rounded on the inner angle. The teeth of the marginal row of the rasp-like anterior portion of the prothorax are not rounded, pointed at the tips, well separated from each other and 10 in number, the middle ones more prominent than the outer. Scutellum very shining, transversely keel-shaped. Punctuations confluent and areolate over the whole surface of the elytra except at the extreme base; the suture is bordered on each side on the declivity by a slight ridge. Closely allied to *D. bifoveolatus* but is bigger and has a shorter prothorax. Long. 3½ millim.

Distribution.—Deccan, Trichinopoly, Madura.

Unrepresented in above collections.

Life-History.—I can find no notes upon the life-history of this species.

4. Dinoderous minutus, Fabr.

Fabricius, 1775, Syst. Ent., p. 45.
Olivier, 1790, Enc. méth., Ins., V, p. 111.
Id., 1795, Ent., IV, No. 77, p. 15, pl. II, f. 12.
substriatus Stephens, 1830, Ill. Brit. Ent., III, p. 352.
siculus Baudi, 1873, Berl. Ent. Zeit., XVII, p. 336.
Id., 1873, Ann. Mus. Gen., 1873, p. 265.
bifoveolatus Zoufal (*non* Wollaston), 1894, Wien. ent. Zeit., XIII, p. 42.
Dinoderus sp. Ind. Mus. Not. Vol. I. Steb. Inj. Ins. Ind. For., p. 42.

Slightly elongated, brown with the dorsal portions of the bases of the elytra lighter-coloured, occasionally almost reddish. The stiff hairs on the front clypeal region always few in number and very short. Antennæ 10-jointed, the funiculus not fringed with hair; the second joint of the club less than one and a half times as wide as long. The teeth of the marginal row of the rasp-like anterior portion of the prothorax are more or less pointed at their tips, not set very close together, the middle ones more prominent than the side ones. Posterior portion of the sides of the pronotum strongly and thickly punctuate, but the punctures do not join and are finely ocellated; median foveoles are well marked. The scutellum is dull and not keel-shaped. Elytra bristling with short reddish hairs becoming denser on the posterior declivities; when sufficiently magnified these hairs are thick, pyriform, and very pointed at their tips. Elytra thickly and densely punctuate, thicker and deeper

[1] The *Bostrichus vertens* Walker, 1859 (Ann. Nat. Hist., 1859, Vol. III, p. 260) of Ceylon is a *Dinoderus* probably identical with either *minutus* or *brevis*.

on their basal portions than on the posterior declivity; punctures on the declivity clearly ocellate; suture not prominent on the declivity. Long. 2½—3½ millim.

Larva.—Pale canary yellow, opaque, curved, wrinkled, the thoracic segments swollen, the prothorax tapering sharply anteriorly to head. Latter small, orange-brown with black mandibles. Three pairs of longish three-jointed legs on thoracic segments, the lowest joints being clothed with scattered yellow bristly hairs anteriorly and ending in a claw. Body tapers posteriorly to a blunt rounded point. Long. 3—3¾ millim.

Pupa.—Resembles that of *pilifrons* but is smaller.

Distribution.—Bombay Presidency (Andrewes). Calcutta (mihi); Burma—Carin Chebà, 900 to 1,100 metres; Teinzó in May, Bhamo in August (L. Fea). Lesne states it to be cosmopolitan in tropical regions. The commonest species of the genus and is at times found in ports and large town in temperate climates.

Specimens present in—*Coll. Ind. Mus. Calcutta* (mihi); *Coll. For. Ent.* ditto; *Coll. Steb.* ditto and Ceylon (latter received from British Museum).

Life-History.—This insect has been so consistently confused with *D. pilifrons* in India that until recently it has been impossible to say certainly what its life-history really was. It was known to infest bamboos and to not improbably often accompany *pilifrons*. It was not, however, present in the bamboos from the Siwaliks, from which I bred the latter in 1901.[1] It was said to be plentiful in houses in the Bombay Presidency, where it flies slowly about from December to January. It was also reported as boring into bamboo in Guadaloupe, in the dry roots of *Smilax borbonica* in the Island of Réunion and in lianas from Brazil in which cotton had been packed (Lesne).

This year (1903) I have had an opportunity of properly studying the life-history of this insect in Calcutta and have the following observations to record. I first noticed the beetles becoming plentiful towards the end of April, at which period they were egg laying. Bamboos in Calcutta were full of the beetles, which were also attacking bamboos brought from the Garhwal Forests in North-Western India. These latter were being converted into telegraph posts. Careful watch was kept on some of these latter bamboos, selected at haphazard from the Government Telegraph workshops in Calcutta, and also on other local ones. Notes have thus been recorded on the insect's life-history from the latter part of April to the end of October. My observations have shown me that the eggs laid towards the end of April

[1] *Vide* Dep. Not. Ins. aff. For. No. 2, p. 17 (1903).

give rise to a generation of beetles in the second or third week of June. These at once lay eggs which produce another generation of beetles towards the end of July. This generation on emerging lays eggs immediately and larvæ are to be found in the bamboos in August, a fresh generation of beetles issuing between the first and third weeks of September. These lay eggs from which another generation of beetles makes its appearance about the middle of October, this latter being the fifth generation produced in the year. The generations, however, although fairly well defined, overlap and it is possible to find beetles at any time between April and October.

5. Dinoderus brevis, Horn.

Horn, 1878, Proc. Ann. Phil. Soc., XVII, p. 550.

Greatly resembles *minutus*, F. Differs in its more convex form and in its 11-jointed antennæ. Dorsal punctuation of the elytra less dense than in *minutus* and not serried. The erect hairs on the posterior declivity of the elytra less dense and slightly longer, cylindrical or subclaviform, not pointed. Long. $2\frac{1}{3}$—$3\frac{1}{3}$ millm.

♀ The two median teeth of the marginal row of the rasp-like anterior portion of the prothorax are larger, wider apart and more prominent than in the ♂.

Distribution.—Lesne gives its distribution as throughout India, Burma—Teinzó (in May), Rangoon (May-July) (L. Fea).

Unrepresented in the collections.

Life-History.—I can find no record of any observations upon the life-history.

Genus *Rhizopertha,* Stephens.

(See Table of Genera 1, 3).

Stephens 1830, Ill. Brit. Ent., III, p. 354.—Wollaston, 1854, Ins. Mader. p. 286.—Lacordaire, 1857, Gen. Col., IV, p. 534 and 541, J. Duval and Fairmaire, 1863, Gen. Col., III, p. 231.—Redtenbacher, 1872, Faun. austr., 3rd. ed., p. 66.—Kiesenwetter, 1877, Nat. Ins. Deutschl., Col., V, p. 40.—Lesne, Ann. Soc. Ent. Fr. 1897, p. 322.

6. Rhizopertha dominica, Fabr.

Fabricius, 1792, Ent. Syst., I, 2, p. 359.
pusilla Fabricius, 1798, Suppl. Ent. Syst., p. 156. Stephens, 1830, Ill. Brit. Ent., III, p. 354. Fairmaire, 1850, Rev. et. Mag. de Zool., 2e Sér., II, p. 50. Wollaston, 1854, Ins. Mader., p. 287. J. Duval

et Fairmaire, 1863, Gen. Col., III, Pl. 57, f 281. Redtenbacher, 1872, Faun. austr., 3e éd., II, p. 67. Kiesenwetter, 1877, Nat. Ins. Deutschl., Col., V, p. 41. Horn, 1878, Proc. Am. Phil. Soc., XVII, p. 550.

picea Marsham, 1802, Ent. Brit., I, p. 88.

rufa Hope, 1845, Trans. Ent. Soc. Lond., IV, p. 16. Waterhouse, 1888, Ann. Nat. Hist., 1888, p. 349.

Long, parallel, reddish-brown. Vertex very smooth and shining, epistome finely and sparingly punctuate. Antennæ 10-jointed, the two first of equal length, the second article of the club transverse, angular on the inner edge. Prothorax nearly as wide as long, slightly wider behind, much rounded at the 4 angles; the teeth of the rasp very short, obtuse; those of the marginal row 12 or 14 in number, all similar to one another, forming a kind of scalloped crest; lateral suture well marked on more than the posterior half, disappearing in front; no median foveoles. Scutellum squarish, slightly widened behind. Elytra with large deep punctures on the dorsal and lateral parts, the punctures being in regular striated rows; posterior declivity uniformly convex, studded with fine rasp-like granulations; suture only slightly prominent on the declivity. Elytra covered with short bristles incurved backwards. Long. $2\frac{1}{2}$—3 millim.

Distribution.—Said to be cosmopolitan in warm countries, even more so than the *Dinoderus minutus*.

In India Andrewes found the insect in houses (in Bombay Presidency ?)

Specimens present in—*Coll. Ind. Mus. Calc.* India.

Life-History.—The beetle has been found by Andrewes in December. Its food appears to be varied as in other parts of the world outside India it feeds upon ship's biscuits and various grains, besides dried vegetable substances and manufactured products.

It has been reported in India as attacking stored wheat (*Triticum sativum*), cholum (*Sorghum vulgare*) seed, and ship's biscuits. No notes appear to have been recorded upon its life-history in India.

Tribe BOSTRICHINÆ.

(See Table des Tribus 1*, 3*)

The tribe is divided into three sub-tribes.

Characters.—The mouth of the *ostrichin* is built on two distinct plans according to the form and placing of the mandibles

present. In the first the mandibles are more or less attenuated in their upper halves and nearly always pointed at their tips and when in play they rub over one another, their ends crossing. Even when short and obtuse at the apex they retain their oblique position and their tips do not meet in repose. In the second division the mandibles are shorter and more robust, as wide at their tips as in the middle, truncate at their ends. They move in the same plane and when at rest they meet one another along the whole length of their sides.

The *Bostrichinæ* with mouth parts built on the first type (oxygnathes) form Lesne's *Bostrichinæ* and *Apatinæ*, those on the second plan (pachygnathes) his sub-tribe *Sinoxyloninæ*.

The *Bostrichinæ* of the first type divide themselves into two groups of which it is easy to define the limits. The absence of the long and thin ovipositor so constantly present in the females of the *Sinoxyloninæ* and *Bostrichinæ sens. str.* suffices of itself to justify the separation of the sub-tribe *Apatinæ* as distinct from the other two.

In the *Bostrichinæ sens. str.* the mesosternum and metasternum meet at the exterior edge of the intermediate coxa except in 8 or 9 species where these pieces are only very slightly apart. In the *Apatinæ* the lateral edges of the meso and meta-sternum are markedly apart. The tarsal joints 2-4 of the *Apatinæ* are furnished near the ends on their under surfaces with dense and regular brushes of hairs. This is rarely found in the sub-tribe *Bostrichinæ sens. str.*

Sub-tribe *Bostrichinæ sens. str.*

I. Bostrichus.

The sub-tribe *Bostrichinæ s. str.* answers to the great genus *Bostrichus* as understood by Guérin-Méneville, Lacordaire and J. Duval. The limits of this genus had never been properly defined till Mr. Lesne's memoir appeared. The following are the characters :—

The labrum always very strongly transverse is at most as wide as the median indentation of the anterior margin of the epistome. The prothorax has no lateral suture and is often prolonged into horns at the anterior angles. Neither the portion of the prosternum situated in front of the anterior coxæ, nor the intercoxal lobe of the mesosternum are thinned out into a blade-like edge. The abdomen has always five visible segments, the first four are simple and it is very

rare for the last to be indented or foveolate. The intercoxal projection of the basal segment is widened into a flat facette on the whole length of its ventral ridge except in *Bostrichus capucinus* L. where this projection appears as a simple pinching of the sternal plate.

Mr. Lesne notes that these characters are perhaps more superficial than well marked and the genera based on them are therefore very close to one another. They are, however, based not only on the relations of those genera to themselves but also to neighbouring groups.

The group Bostrichus is divided into eleven genera, *Bostrichus*, *Schistoceros*, *Parabostrichus*, *Neoterius*, *Bostrichoplites*, *Dexicrates*, *Lichenophanes*, *Heterobostrichus*, *Bostrichopsis*, *Bostrichulus* and *Sinoxylodes*, of which representatives of only the genera *Schistoceros*, *Lichenophanes*, *Heterobostrichus* and *Bostrichopsis* appear to have as yet been reported from India. The following are Lesne's characters of these four genera :—

TABLEAU DES GENRES.

2-1—Saillie intercoxale du 1er segment apparent de l'abdomen presentant une façette plane ventrale dont les arêtes marginales se continuent sans interruption avec les carinules limitantes des cavités coxales.

3-4—Articles de la massue antennaire parcourus sur chaque face par deux fins canalicules longitudinaux. Angles antérieur de l'épistome pointus, plus ou moins aigus . . G. *Schistoceros.*

4-3—Articles de la massue anténnaire sans canalicules longitudinaux sur leur deux faces.

8-5—Meso et métasternum en contact au bord externe de la hanche intermédiaire. Prothorax sans rangée marginale de dents le long de son bord antérieur.

10-9—Tête sans constriction postoculaire. Cadre buccal mois denté au-dessous des yeux.

11-14—Angles antérieurs de l'épistome obtus ou arrondis. Articles de la massue antennaire avec des taches pileuses nettement délimitées. Pronotum généralement un peu excavé audessus de son bord antérieur.

13-12—Épisternites abdominaux non apparents. Nervure dorsale interne des élytres renflée et saillante prés de la base . G. *Lichenophanes.*

14-11—Angles antérieurs de l'épistome droits ou aigus, pointus.

15-16—Pronotum légèrment excavé audessus du milieu de son bord antérieur. Artrcles de la massue antennaire sans taches pileuses nettement délimitées . .
G. *Heterobostrichus.*

16-15—Pronotum nullement excavé en avant.

17-18—Front ou déprimé en arrière, ou saillant au bord antérieur par rapport à l'épistome. Taille moyenne : 6-21 millim.
G. *Bostrichopsis.*

The habits of the above genera would appear to be somewhat similar, but little is known upon the subject at present. Bamboos and the wood of the sâl (*Shorea robusta*), cotton tree (*Bombax malabaricum*), and Guava (*Psidium Guava*) have been reported as infested by species of these genera.

Genus *Lichenophanes*, Lesne.

Lesne, An. Soc. Ent. Fr., 1898, p. 457.

Forehead simple, generally not gibbous, flat or very slightly depressed transversely at the level of the posterior edge of the eyes, sometimes gibbous in comparison with the epistome and sloping in front. Frontal clypeal suture straight or slightly arched, more or less well marked. Epistome truncate or hardly indented in front, its anterior angles obtuse or rounded. The buccal border without a tooth or prominent lobe beneath the eyes. Posterior edge of the eyes turned up, the temples forming beneath a re-entering angle more or less well defined. The joints of the antennal club each ornamented on either face with two or more well-defined velvety circular patches which are often golden coloured. Posterior angles of the prothorax well marked having the form of lobes or of more or less pointed tubercles. Sculpture of the posterior surface of the pronotum mixed with prominent granules and never having the appearance of imbricated scales. Elytra lobed or tuberculate on the basal portion on either side of the scutellum, their innermost dorsal nervure swollen and prominent at least near the base. Fifth visible segment of the abdomen simple, rounded behind, and furnished laterally with a marginal channel. Posterior tibiæ without long hairs on their external faces. Anterior tarsi shorter than the corresponding tibiæ.

This genus contains a large number of species which are remarkable for their varied colouring, the colouration often closely imitating the colour of bark or of tree lichens amongst which these insects pass the greater part of their lives. It is probable that many unknown species exist in the Indian Region.

7. *Lichenophanes khmerensis,* Lesne.

Lesne, 1896, An. Soc. Ent. Fr., 1896, p. 511. *Ibid.* 1898, 473.
? *carinatus* Lewis, 1896, An. Nat. Hist., 6, XVII, p. 339.

Elongate, parallel, the elytra slightly widened behind; brown splashed with red. Forehead fairly densely granulate and only slightly pubescent in front. Frontal clypeal suture indistinct on the sides, well marked in the middle. Epistome granulate and pubescent, without long hairs, the anterior angles widely rounded. The eyes with a sharp angle behind. The golden blotches of velvety hair upon the divisions of the antennal club well marked. Prothorax well rounded on its sides, narrowed in front and behind, its anterior angles prominent, pointed, but wide and depressed, the posterior angles prominent and pointed. Pronotum slightly excavated above its anterior edge; the prominent lateral teeth of the rasp 4 or 5 in number; the posterior space studded with big rounded granules and having a median central area smooth and shining down the middle of which a fine channel runs almost the whole length of the posterior space. Pubescence of the pronotum rufous, fairly dense. Elytra strongly and densely punctuate, subgranulous in the interspaces. Apical declivity without marginal tubercles, the apical angle being simple; suture well marked and hardly conspicuous on the declivity. Elytral pubescence placed in patches of varying size, longitudinally compressed; the hairs of which these patches consist are pressed down flat upon the integument. Punctuation and pubescence of the abdomen fine and dense. The second joint of the anterior tarsus is much shorter than the last, second and fifth joints of the posterior tarsus are sub-equal. Long. 9-11½ mill..

Distribution.—The British Museum contains one specimen from the Andaman Islands.

Unrepresented in *Coll. Ind. Mus.*, etc.

A closely allied species as yet insufficiently known.—*Bostrichus carinatus*, Lewis (*sub Apate*), named from a single individual from the Andaman Islands (Coll. Gorham) is closely allied to *khmerensis*. It is larger, has not the central shining space with its fine channel on the posterior surface of the pronotum and has the sides of the thorax, according to the original description, parallel and is 13 millim. in length.

Genus *Schistoceros,* Lesne.

Lesne, Rev. des Bostr. 3 Mem. in An. Soc. Ent. Fr., Vol. LXVII, p. 502 (1898).

Amphicerus Leconte, 1861, Class. Col. N. Amer., p. 208. (*partim*).—Horn, 1878, Proc. An. Phil. Soc., XVII, p. 541 et 546.

Cænophrada Waterhouse, 1888, An. Nat. Hist., 1888, I, p. 350 (*ad part*

Cylindrical. Front simple or gibbous anteriorly, sometimes slightly depressed behind. Anterior angles of epistome sharp, pointed. The buccal border without a prominent tooth beneath the eyes. Articulations of the antennal club are provided with two long fine longitudinal channels on each face. Prothorax markedly narrowed in front, not hollowed out above its anterior margin. Elytra without prominent dorsal nurvures. Meso and metasternum meet at the outer edge of the intermediate coxa. The fifth apparent abdominal segment simple. Sometimes slightly sinuate in the middle of the posterior margin.

The species of the genus are divided by Lesne into four divisions. Only one Indian species appears to be yet known, so it is at present unnecessary to consider these different divisions here.

7. *Schistoceros anobioides,* Waterh.

Waterhouse, 1888, An. Nat. Hist., 1888, I, p. 350 (♀) (*sub Cænophrada*).
Lesne, 1897, An. Belg., 1897, p. 18 (♂).
Id. 1898, An. Fr., p. 519.

This species is very closely allied to a Malay and also a Chinese one, *S. malayensis* and *S. cænophradoides*, both of which may prove to be inhabitants of the Indian Region proper.

Long. 12-18 millim. Dark brown to black; anterior edge of the prothorax covered with a bright red pubescence; pubescence on under-surface of insect rufous and dense. Prothorax not as wide as long and markedly narrower in front, rounded on the sides and at the posterior angles. The posterior space of the pronotum covered with imbricate scales (♂) or flat granulations (♀). Forehead very finely and slightly punctured, crescent-shaped when looked at from behind. Apical declivity of the elytra with two marginal tubercles on each side, less marked in ♀; unpunctured on their lower half, their lower border joined along their whole length with the edge of the elytra.

In the ♀ the punctuation on the elytra is slighter and the eyes are distinctly larger than in *S. malayanus* and *cænophradoides*. Some females are rendered remarkable by having an elytral sculpture which becomes rasp-like owing to the development of small tubercles in the intervals of the punctuation. In both sexes elytra are covered with a very fine and short rufous pubescence.

The chief character of this species is furnished by the conformation of the antennæ of the ♀.

Distribution.—India: Bengal—Calcutta, Dinapur, Chota Nagpur, Hazaribagh; Central Provinces,—Saugor; Bombay—Belgaum (in March), Canara, Sind; Madras: Ceylon: Burma.

Coll. Ind. Mus. Calc.—Hazaribagh, Bhadra: *Coll. Steb.*—Karachi Museum.

Life-History.—In Indian Museum Notes, Vol. II, p. 150, this species is said to tunnel into the wood of guava trees. Trees in Hazaribagh were reported to be so infested. This information is very meagre and it is not stated whether the trees were dying or dead. Although the species would appear to be widely distributed in India, nothing further upon its life-history has been observed.

Genus ***Bostrichopsis,*** Lesne.

Lesne, Rev. des Bostr. 3rd Mem. in An. Soc. Ent. Fr., Vol. LXVII, p. 524 (1898).

Body cylindrical. Cephalic capsule without a post-ocular constriction. Head not regularly convex above, its dorsal profile not forming an arc of a circle. Buccal border not indented beneath the eyes. Articulations of the antennal club with more or less well-marked golden yellow velvety patches. Prothorax not hollowed out over its anterior edge. This latter with no marginal row of teeth. Its posterior angles round or straight, not lobed. Elytra without keel-shaped processes or tubercles in front. Last visible segment of the body rounded behind.

The *Bostrychopsis* are of small size and brown colour and are spread over all the warmer parts of the world, with the exception of apparently C. America and the Pacific Archipelago.

The peculiarity about the genus is that there are several different forms of ♂ and ♀ present. According to their mutual affinities, Mr. Lesne divides the different specific forms of this genus into six groups. His groups I and II consist of those species confined to the Old World. His group III of one species *B. Jesuita,* which he confines to Australia but which the writer has found in India, Mr. W. F. H. Blandford having identified my specimens in the British Museum in 1897.

Species of group I do not appear to have been yet reported from India.

The following are the characters of group II :—

Heteromorphous ♂: Body generally larger and thicker than the ♀. Forehead simple, the frontal clypeal suture obsolete on the sides, sunk in the middle. Prothorax larger than in the ♀, prolonged at its anterior angles into horns strongly curved downwards and recurved at their tips. Apical declivity of the elytra wider than that of the ♀ and furnished on each side with two marginal callosities. The pleural parts of the last visible segment of the abdomen generally

plainly visible and reddish or rufous in colour. Long hairs on the under-surface of the tarsi are numerous.

Heteromorphous ♀ : Forehead nearly plain or lightly gibbous and deflexed at its anterior edge. Frontal clypeal suture well marked. Prothorax smaller than in the ♂, truncate in front, its outer angles not prolonged into horns. The marginal callosities of the apical declivity of the elytra absent or only very slight. Fifth apparent segment of the abdomen with a thick fringe of red hair in the middle of the posterior edge. The long hairs on the under side of the tarsi rarely present.

Homeomorphous ♂ : Head and prothorax as in the heteromorphous ♀. Elytra as in the heteromorphous ♂.

Homeomorphous ♀: Anterior angles of the prothorax prolonged into horns which are less well developed than in the heteromorphous ♂. Otherwise resembles the heteromorphous ♀.

The members of this group appear to be confined to the warmer parts of the Old World.

8. Bostrichopsis parallela, Lesne.

Lesne, An. Soc. Ent. Fr., 1898, p. 534.
Bostrichus parallelus, Lesne, An. Soc. Fr., 1895, p. 174. Steb. Dept. Not. Ins. For. No. 2, p. 174.

Dorsal punctures of the elytra well marked, becoming slightly more dense on the apical declivity. The second joint of the posterior tarsus is distinctly wider than the last. The deep punctures on the dorsal surface of elytra often become elongated near the suture. In the ♀ the forehead is finely and densely pubescent in the centre but not gibbous. The apical declivity with a weak border becoming more marked near the sutural angle. Length 6—15 millim.

The prothorax is smaller than in ♂; generally it is nearly square, truncate and slightly sinuous on its anterior margin and the sides of the body are parallel. But small ♀ exist also heteromorphous, of which the body is shorter, not parallel, the prothorax rounded on its edges and the elytra slightly widened behind. The punctuation of the abdomen of these small ♀ is less dense than in the typical ♀ and the anterior margin of their prothorax is at times slightly indented.

Three kinds of ♂ are present : first, the normal heteromorphous ♂, in which the anterior angles of the prothorax are prolonged into horns which are curved downwards and have a glabrous outer surface. In the elytra the apical declivity bears the four ordinary marginal costiform callosities. On each side the lateral callosity is conterminous with the lower border which is well marked as in *B.*

tonsa; but, ordinarily, this lateral calus is situated inside of the curve which prolongs the lower border. *2nd.*—A homeomorphous ♂ remarkable for the singular mixture of the ♂ and ♀ characters. Its forehead is slightly turned up in front as in the ♀ and clothed in the middle as in her case with a light-coloured close pubescence but the area over which this is spread is less than in the ♀. The prothorax, which in its general form and size is that of the normal ♂ has no horns. In their place on each side there are present two teeth, turned up and placed close together of which the inner one is slighly narrower than the outer; between these teeth the anterior edge is slightly indented. The elytra are also by their size the elytra of the ♂ but they have no marginal callosities on the lateral edges of their apical declivity and the two callosities of the upper edge are hardly perceivable. Below the declivity shows a prominent and thick border, diverging laterally from the edge of the elytra. *3rd.*—A series of forms, also homeomorphous, in which the head and the prothorax are shaped as in the preceding ♂ in all except that at times the inner tooth of the anterior angle of the prothorax is absent, but in which the apical declivity of the elytra is furnished with marginal callosities more or less prominent.

Distribution.—Indian Region. Throughout the Deccan, Central Provinces (Raipur); Chota Nagpur (Singbhum); Bengal; Assam.

Coll. Ind. Mus. Calc.—Calcutta: *Coll. For. Ent.*—Raipur: *Coll. Steb.*—Raipur, Calcutta.

Life-History.—This insect was found boring in June into cut and stacked bamboos (*Dendrocalamous strictus*) by the late Mr. A. M. Long of the Imperial Forest Service in the Raipur Forests of the Central Provinces. The beetle was probably egg-laying in the bamboos.[1]

Mr. Lesne mentions that Quérin-Méneville found it in the roots of *Smilax china*.[2] This appears to be all the information at present available on the life-history of this insect.

A live specimen was brought to me to the Museum in Calcutta about the middle of May of this year (1903). It was found in a street. This proves that it is on the wing in May in this locality.

9. *Bostrychopsis bengalensis,* Lesne.

Lesne, An. Soc. Ent. Fr. 1898, p. 537.

Bostrichus bengalensis, Lesne, An. Soc. Ent. Fr. 1895, p. 174 (♀).

[1] *Vide* Dep. Not. Ins., For. No. 2, p. 174. (1903).

[2] Mr. Lesne remarks that this is probably Quérin-Méneville's *Bostrichus Thoyeli* (An. Fr., 1845, Bull. p. xvi), of which he published no descriptio .

Differs from *B. parallela* in having the 2nd tarsal joint not or only very slightly wider than the last. The scales on the centre of the posterior surface of the pronotum are a little larger. ♀. Forehead without pubescence. Body more elongate than above species. The abdominal punctuation is very fine and less dense in the middle than at the sides. Length 9½ to 13 millim.

Only the ♀ is known. The species is closely allied to *B. parallela* and *affinis*. The absence of the dense frontal pubescence distinguishes it at once. In addition the ♀ is not a heteromorphous one like those of the above mentioned species: the anterior angles of its prothorax are prolonged into horns curved downwards and recurved at their tips. The absence of the frontal pubescence distinguishes it at the first glance from *B. parallela*.

Distribution.—Bengal, Chota Nagpur, Mynpoore, Sind.

Unrepresented in *Coll. Ind. Mus. Calc.*, etc.

Life-History.—Little appears to be known under this head at present.

Characters of Group III (see above).

Differs from Group II in the posterior tibiæ bearing some hairs on their outside edge. The golden velvety patches on the articulations of the antennal club well-marked. The marginal groove of the elytra gradually thinning out behind. The deep pits on the back of the elytra reniform in shape near the suture.

Heteromorphous ♂. Prothorax prolonged into horns at the extreme angles. The posterior surface of the pronotum furnished with a sculpture resembling imbricate scales. The apical declivity of the elytra with only one marginal callosity on each side, the upper one being absent. (Mr. Lesne adds to this—Beneath the lateral calus, in the case of the ♂ only, an additional calus is present, triangular, shining, and separated from the edge of the elytra by the marginal groove.)

Heteromorphous ♀. Anterior edge of the prothorax truncate or slightly indented, the anterior angles not prolonged into horns, only indicated or toothed on the outside. The posterior surface of the pronotum covered with flat granulations. Marginal callosities of the apical declivity obsolete or less marked than in the ♂.

Homeomorphous ♀. Resembles the preceding one but has the anterior angles of the prothorax prolonged into horns less curved and much shorter than those of the ♂.

10. Bostrichopsis jesuita, Fabr.

Fabricius, 1775, Syst. Ent., p. 54.—*Id.*, 1792, Ent. Syst., I, 2, p. 361.—Boisduval, 1835, Voy. Astrol., II, p. 461.

Canarii Nördlinger, 1880, Lebensw. von Forstkerf., 2e éd., Append., p. 66.

Bostrichus jesuita, Steb. Inj. Ins. Ind. For. p. 42 (1899).

Lesne, An. Soc. Ent. For., 1898, p. 539.

Length 11—19 millim.—Black. Elytra very slightly widened behind in the ♂. Forehead slightly depressed. Frontal clypeal suture quite distinct in the middle. Dorsal punctuation of the elytra very dense and large. The marginal groove of the elytra gradually thins out behind.

♂. Forehead smooth and shining in the middle, punctate on the sides and on the anterior edge. Epistome finely punctuate. Prothoracic horns parallel, curved downwards at a right angle. Posterior angles of the prothorax granulated. Scutellum shining, tubercular, with a few deeply marked pits. The dorsal pits on the elytra reniform in shape. Apical declivity of the elytra slightly concave, less densely puncuate than the dorsal portions, the punctuation thinning out below. Suture slightly prominent on the declivity. Abdomen densely punctuate and densely and finely pubescent. Posterior tarsi with long hair, their joints 2 and 5 sub-equal.

♀ Body longer than that of the ♂. The middle of the forehead has a fine and scattered punctuation, rasp-like except right in the centre, where it is smooth. Apical declivity of the elytra not concave, at least as densely punctuate on its upper half as the dorsal area of the elytra; lateral callosity of the elytra hardly indicated, the lower border less thick than in the ♂. Posterior tarsi without long hairs, their second joint distinctly longer than the last. Transitional forms between the heteromorphous and the homeomorphous ♀ occur, but they appear to be rare. The eyes are smaller in the ♂ than in the ♀; their size varies greatly in the latter sex.

Distribution.—Lesne gives the whole of Australia as the habitat. Specimens, however, which I procured in Chota Nagpur in 1897 were identified for me as this species by Mr. Walter F. Blandford in that year. Therefore I add—*India.*—Chota Nagpur (Singbhum).[1]

Coll. Ind. Mus. Calc., etc., unrepresented.

Life-History.—Little is known on this subject. The writer found the insect boring into the posts and rafters of Sâl (*Shorea robusta*) in newly constructed forest rest houses in Chota Nagpur between March and June 1897. The ♀ bore into the wood and oviposit there.[1] Lesne states that this is the insect of which Nördlin-

[1] In the face of a recently received letter from Mr. Lesne in which he says that he has never seen or heard of other specimens of this species from India endeavours will be made to procure my original specimens for submissal to him.

ger found an immature and dead specimen in the sapwood of *Canarium australianum*. M. Olliff calls it a 'bark borer' and says it attacks the pepper-tree and the White Cedar.[2]

Genus ***Heterobostrichus,*** Lesne.

Body cylindrical or a little depressed. Head without constriction at the level of the posterior edge of the eyes. Anterior angles of the epistome pointed, straight or obtuse (*H. aequalis*). Under lip trapezoid, simple in the two sexes. The articulations of the antennal club without well-defined velvety patches. Prothorax markedly narrower in front, slightly hollowed out above the middle of its anterior edge. Elytra without prominent dorsal nervures, not granulated or toothed at their lower apical edge, their marginal grooves sharply terminated before the apex. Meso and metasternum are in contact on the outside edge of the intermediate coxa. The intercoxal projection of the first abdominal segment showing a flat ventral facette. Fifth segment of the abdomen simple. No long stiff hairs on the external edge of the tibiæ.

The species of this genus inhabit the warm portions of the Old World. They belong to four well-marked divisions which have the following characters :—

Group I.—The frontal-clypeal suture obsolete. No re-entering angle at posterior edge of the eyes. Posterior angles of the prothorax generally rounded. Anterior tarsi with a fringe of light coloured hairs on the inner edge.

Heteromorphous ♂. Forehead simple, with a rectilinear profile. Prothorax large with a prominent hook at each anterior angle. The posterior surface of the pronotum furnished with a sculpture resembling imbricate scales. On each side of the upper edge of the apical declivity of the elytra there are two tubercles of which the inner one is hook-like.

♀. Forehead furnished with a velvety gibbosity which encroaches on the epistome. Prothorax smaller, slightly indented on its exterior edge, its interior edges marked but not prominent. Apical declivity of the elytra without marginal tubercles.

Homeomorphous ♂. Forehead as in ♀; differs from heteromorphous ♂ in having the uncus of the anterior angles of the prothorax at times replaced by a simple upturned tooth.

Two species are known.—*H. unicornis* and *H. pileatus*—both Indian.

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[1] *Vide* note on this insect in Inj. Ins. Ind. For. p. 42 (1899).

[2] Insect Life, IV, Nos. 9-10, 1892, p. 294.

11. Heterobostrichus unicornis, Wat.

Bostrichus unicornis, Waterhouse, 1879, An. Mag. Nat. Hist. 5th Ser., III, p. 361.

Fairmaire, 1893, Ann. Belg. 1893, p. 539.

Lesne Ann. Soc. Ent. Fr. 1898, p. 558.

Prothorax as wide as long. Elytra glabrous, with well-marked punctuation. ♀. Transverse diameter of the frontal arc does not cover one-quarter of the inter-ocular space.

Long. 9½—11½ millim.—Long, parallel, dark brown with thighs slightly reddish and the antennal club rufous. Elytra glabrous. Heteromorphous ♂ unknown.

♀. Head furnished above with a tubercle densely hairy, situated in the passage of the frontal clypeal suture and encroaching both on the forehead and on the epistome. The diameter of this tubercle does not cover a quarter of the space between the eyes. Punctuation on forehead very fine and dense. Prothorax slightly rounded at sides, greatest width in middle; anterior margin slightly indented, the indentation bounded on either side by an erect but not prominent tooth; posterior angles rounded. The middle of the posterior space of the pronotum covered with fine and dense flattened granulations. Elytral punctuation well marked, homogeneous, not in regular lines. Apical declivity depressed on either side of the suture, the latter not prominent. Sutural angle shining and not punctuate. Apex of elytra slightly turned up. Intercoxal lobe of the mesosternum with a fine median keel. Abdominal punctuation fine and dense, the pubescence being excessively fine. Joints 2 and 5 of the posterior tarsi sub-equal.

Homeomorphous ♂. The type of the species is a homeomorphous ♂. Head as in ♀ but elytra furnished on either side on the upper edge of the apical declivity with two tubercles, the outer one simple, the inner larger and prolonged into a robust horn curved inwards.

Distribution.—India: Canara in Bombay Presidency. (Taken by C. R. D. Bell), Madras, Rangoon.

Coll. Ind. Mus. Calc.—Andaman Islands, Calcutta.

Life-History.—Nothing appears to be known about this.

13. Heterobostrichus pileatus, Lesne.

Lesne, Ann. Soc. Ent. Fr., 1898, p. 559.

Prothorax longer than wide. Elytral punctuation less well marked.

♀. Tranverse diameter of the frontal arc covers more than a third of the inter-ocular space.

Length, 9—11 millim. Very similar to *unicornis.* Prothorax is widest slightly behind the middle. In the ♀ the arc or hoop is much

larger than in *unicornis;* prothorax is narrower, anterior angles less well-defined, posterior angles are more widely curved. Hairs on the anterior tarsi double the length. Abdominal punctuation finer.

Heteromorphous ♂ : Head and prothorax larger than in ♀. Forehead simple, smooth and shining in the middle. Anterior angles of the prothorax each furnished with an uncus which bounds on either side a median narrow and shallow indentation. The lower marginal tubercle of apical declivity of the elytra only slightly developed, compressed and not conterminous with the lower edge, the upper tubercle much larger, prolonged into a horn curved downwards and inwards.

For the description of the homeomorphous ♂[1] see above under description of group.

Distribution.—India: Canara (Bombay Presidency); Tharrawaddi (Burma).

Coll. Ind. Mus. Calc.—Cochin.

Life-History.—Nothing appears to be known at present.

Group II.—Forehead similar in the two sexes. Epistome convex and a little swollen. The frontal clypeal suture obsolete and not sunken in the middle. Anterior angles of epistome obtuse, not prominent but pointed at the top. Eyes slightly turned upwards behind. Posterior angles of the prothorax marked, often lobed. The posterior surface of the pronotum showing deep impressed pits and adorned in the middle with a more or less defined sculpture resembling imbricate scales. Apical edge of the elytra prolonged and slightly turned back. Fifth abdominal segment fringed with long rufous hairs in the middle of its posterior margin. Second tarsal joint of posterior feet shorter than the last.

Heteromorphous ♂: Prothorax larger, the posterior surface of the pronotum with very scattered punctuations. Apical declivity of elytra furnished above on each side with two marginal tubercles of which the inner one is hook-like.

♀. Prothorax smaller. The posterior surface of the pronotum densely punctuate. Apical declivity of the elytra without marginal tubercles.

Homeomorphous ♂: Prothorax as in the ♀. The inner upper marginal tubercle of the apical declivity much less developed than in the heteromorphous ♂. Only one species as yet described—*H. aequalis.*

14. Heterobostrichus aequalis, Wat.

Waterhouse, 1884, *Proc. Zool. Soc. Lond.*, 1884, p. 215, Pl. XVI, f. 3 (2) (♀).

[1] One specimen taken at the Seven Pagodas, Tonkin.

uncipennis, Lesne, 1895, An. Fr. 1895, p. 173 (♂ ♀).

?papuensis, MacLeay, 1886, Proc. Linn. Soc. N. S. W., 2nd Ser., p. 154 (♀).

Bostrichus aequalis, Ind. Mus. Not. V. 1. 34. Pl. III, fig. 7.

Lesne, An. Fr., 1898, p. 560.

Long. 6—13 millim. Parallel, very slightly depressed, of a more or less dark brown colour, often rufous, glabrous beneath; thighs often reddish. Forehead and epistome rasp-like, the punctures being irregularly distributed with very short and not thick pubescence. Elytra strongly and densely punctuate, the pits arranged in fairly regular rows of striæ; punctuation of the apical declivity variable. Apical edge of the elytra turned back and furnished with a border thickened laterally and separated from the edge of the elytra. Abdomen with a very firm and very dense punctuation, rasp-like, its pubescence very fine, and not easily perceivable. Second tarsal joint of hind legs much shorter than the last. Most of the different sexual characteristics have been given above. Heteromorphous ♀. The prothorax is sometimes wider than the elytra, its posterior angles not being, or only very slightly, lobed and the tooth of the interior angles is generally more prominent than in the other forms. The spacing of the large sunken pits on the posterior surface of the pronotum allows of the ground sculpture being seen which appears like imbricate scales, shining, and with finely marked contours. Apical declivity of elytra shows on either side on its upper edge, a longish tooth, slightly inclined towards the long axis of the body and curved inwards above. Outside of this sort of uncus is a costiform callosity.[1]

In the ♀ prothorax is smaller, its posterior angles are nearly always lobed; the deep pits which cover the posterior surface of the pronotum are so close together as to obliterate any other sculpture. On either side of the upper edge of the apical declivity of the elytra there are only two costiform callosities, very little prominent.

Males are to be found much smaller than the ordinary heteromorphous ♂ and having a proportionately smaller prothorax resembling that of the ♀. In these the elytral tooth is short and not, or hardly, curved or it may even be replaced by a simple prominent edge.[2] But this homeomorphous form is not fixed and all gradations are found.

Further, this elytral tooth of the ♂, even when well developed, is very variable. More or less wrinkled and punctuate at its base, it is at times simple, regularly arched and thinned out at its tip, or it is furnished near the middle of its posterior face with a tubercle which

[1] These elytral teeth and callosities are similar to those of the males of *H. unicornis* and *pileatus* and similar ones are not to be found in any other Bostrichids.

[2] One specimen from Soembawa (Coll. Bedel).

gives it the appearance of being bifurcated. The punctuation of the apical declivity of the ♂ may be greatly or less well-marked and dense.

♀ are to be found in which the upper inner callosity of the declivity is replaced by a costiform tubercle very short but pointed and well-marked. These ♀ resemble greatly certain ♂.

Larva.—White, curved, with brown-black head and three pairs of jointed legs.

Distribution.—India: Sutlej; environs of Simla; British Bhutan; Maria Basti; Calcutta (mihi); Calicut (Madras); Bhamo; Tharrawaddi.

Coll. Ind. Mus. Calc.— Calicut (Madras); *Coll. Steb.*—Andamans (received from Br. Mus.), Singbhum (Chota Nagpur), Calicut, (Madras).

Life-History.—The beetle has been reported as tunnelling into and laying its eggs in the wood of *Bombax malabaricum* at Calicut. As this wood is used for tea boxes by planters on the west coast of Madras, the damage caused is considerable. The adult insect is to be found on the wing in May-June.

Group III.—Front not at all depressed, epistome not swollen, the profile of the upper part of the head describing in both sexes a regular curve. Frontal clypeal suture well marked in the middle. Eyes very slightly turned upwards behind. Posterior angles of the prothorax straight or obtuse, nearly always pointed at the top and sometimes a little lobed in the ♀. Apical edge of the elytra not reflexed. Second and fifth tarsal joints of posterior legs subequal.

♂. Anterior angles of the prothorax prolonged into upturned horns. The centre of the posterior surface of the pronotum covered with scales. Apical declivity of the elytra furnished on each side with a marginal apophysis. The pleurites of the last abdominal segment more visible.

♀. Anterior angles of the prothorax furnished with only one erect large tooth. Centre of the posterior surface of the pronotum covered with rasp-like granulations. Apical declivity of the elytra showing on either side a marginal callosity.

One species only—*H. hamatipennis.*

Heterobostrichus hamatipennis, Lesne.

Lesne, 1895, An. Fr., 1895, p. 873 (♂ ♀). An. Fr., 1898, p. 562; *niponensis*, Lewis, 1896. An. Nat. Hist. Sér. 6, vol. XVII, p. 339 (♂).

Frontal clypeal suture strongly depressed in the middle. Eyes slightly inclined behind. ♂ with prothoracic horns.

Long. 9—15½ millim. Parallel, fairly large, robust; dark brown with thighs at times reddish. Upper part of the body covered with a

rufous pubescence, very short and sparse, denser near the anterior edge of the pronotum and, in the ♂, on the apical declivity of the elytra, which often appears as if covered with a sort of yellowish pulverescence. The pubescence on the scutellum dense, often appearing as a well-marked light coloured blotch. Ventral pubescence less short and more abundant than that of the upper part of the body. Head large. Forehead more or less punctuate, or rasp-like. Epistome densely pubescent, especially in the ♀, with a fine longitudinal keel in the middle. Labrum pubescent above. Sculpture of the posterior surface of the pronotum fairly large, rasp-like, consisting of scaloidal tubercles more prominent in the ♀. Posterior angles of the prothorax generally straight, pointed, rarely rounded at times slightly lobed in the ♀. Dorsal punctuation of the elytra well marked and dense and arranged in regular series.

♂. Apical declivity is usually less strongly and less densely punctuate than the back of the elytra and has, on each side, a marginal subcylindrical apophysis, fairly thick, and obliquely truncate at the top and pointed on the inside. The lower border of the declivity plain, shining and detached laterally from the edge of the elytra. Joints 2-4 of the anterior tarsi furnished with long hairs beneath.

♀. Eyes larger, apical declivity as strongly or more strongly punctuate than the dorsal region, the punctuation being very closely serried; marginal processes replaced each by a callosity; the lower border not laterally distinct from the edge of the elytra. Anterior tarsus without long hairs beneath.

This species is fairly variable as far as the sculpture and dorsal pubescence are concerned, also with regard to the form of the anterior indentation and the posterior angles of the prothorax and above all as to the shape of the elytral apophyses of the ♂, whose position with reference to the suture also varies to a certain extent.

H. hamatipennis forms the transitional form between the present genus and the next one, the *Bostrichopsis*. The ♂ has in fact many of the characters of the heteromorphous *Bostrichopsis* ♂: cephalic profile, frontal-clypeal suture, clypeal pubescence, prothoracic horns, and the visibility of the pleurites of the last apparent segment of the abdomen.

Distribution.—India—Jhelum Valley; Dehra Dun; Sikkhim; British Bhutan; Maria Basti; Sylhet; Maïssour (?), Ceylon.

Coll. Ind. Mus. Calc.—Jhelum Valley; *Coll. Steb.*—Sylhet (from Br. Mus. Coll.); *Coll. Green*—Yatiyantota (Ceylon).

Life-History.—Nothing appears to have been recorded on this point.

6. A PRELIMINARY REPORT ON TWO SERIOUS PESTS OF THE INDIGO PLANT.[1]

By H. W. Peal, F.E.S.

Assistant Entomologist, Indian Museum.

Thanks to the pains-taking work undertaken by the late Mr. de Nicéville in Behar in 1901 a large number of the Lepidopterous pests of Indigo have been discovered and in some cases worked up. There are, however, in addition to these pests several others which undoubtedly do great damage, at any rate in some districts.

To mention some of the more important: there are several species of grasshoppers, including some of the green long horned species (Family Locustidæ), a membracid (order Hemiptera), an aleurodid (order Hemiptera), an aphid (order Hemiptera). Two species of chrysomelid beetles (order Coleoptera) and a cricket (*Gryllus sp.* order Orthoptera) and a species of thrips (order Physopada).

So far as my present observations go, judging from the amount of damage done in the fields, the Chrysomelid beetles do but little injury.

The membracid and the aleurodid, though occurring on both native and Natal plants, are without doubt primarily pests on the latter, and though not excessively numerous, might, with the increased use of Natal plant (which is probable), become serious hereafter. I have but little doubt that taken all round the various species of grasshoppers are among the most serious of the insect pests on indigo. They are not confined to any particular districts, occur in the indigo fields in amazing numbers and are apparently regardless of weather conditions, as I have found them abundant both during the dry hot months and also during the rains.

A cricket (*Gryllus sp.*) is very abundant in some of the indigo districts. It forms burrows all over the indigo fields, sometimes so thickly that several burrows occur in a square foot. Not only are they destructive owing to their numbers but also because of the habit they have of biting off the young indigo plants from near the ground in order to feed on the leaves.

In some districts (the southern ones) where the rainfall is either late or scanty, the most serious pests undoubtedly are the Aphid and the Thrips.

[1] This Report is the outcome of a tour paid by the Assistant Entomologist to the Indigo Districts in May 1902.—*Ed.*

In May at Peberenda, Dalsingsarai, I found the indigo in the neighbourhood to be seriously damaged by these pests. I was informed that the plants had been attacked by these insects ever since the 2-leaf stage. There is but little doubt that when the plant is in its 9- or 7-leaf stage the aphid causes the death of many of the plants. I almost invariably found that plants free from thrips and aphid were comparatively robust and healthy, while these insects occurred in numbers on stunted indigo plants. I should estimate that on an average healthy and unaffected plants were from four to six times taller than infested plants.

Taking these pests in detail.—

The *Indigo aphid.*

The Indigo aphid is an insect belonging to the family Aphidæ (plant lice) of the order Hemiptera or bugs. It can be immediately distinguished in the winged state from the indigo psyllid (*Psylla isistis*, Buckton) by the venation of the wings. As a matter of fact winged specimens of *Psylla isistis* have never been found. The venation, however, will agree in general characters with the psyllid type, but I am not certain, until the winged adult is discovered, under what sub-family of the Psyllidæ, *Psylla isistis* will fall. The wingless specimens can be distinguished by their globular bodies, the body of *Psylla isistis* being flattish in the larval and pupa stages. The aphids vary from light green to brown in colour. The winged specimens are dark brown. The wings are transparent and the veins show as brown lines. (*See* Plate IV, fig. 12, 12 *a*, 12 *b*.)

These insects cluster in large numbers upon the indigo stems, terminal shoots and leaves. So thickly are they crowded together that it is usually impossible to see the stem itself. In May, though the greater number of the aphids were wingless, winged ones were present. I am unable to say how many generations the aphid passes through from the time the indigo appears above ground to the commencement of the rains, but it is probably several. As however, weather conditions, climate and the like, have great influence on the number of generations, there is little value in working the matter up beyond discovering the average number of generations in this period. It is important, however, to discover its alternative food plant or plants if any. In my opinion this insect does a great deal of harm, especially in those years when rainfall is late and scanty as the plant is unable to recuperate from the attack of the aphids. This damage I should estimate can run up for the first mahai to as far as 4 or 6 annas of the crop, and in some cases possibly more. All the plants I examined, which were very

small, averaging some 2 or 2½ inches in height instead of some 18 inches, the average size at the time, I invariably found to be thickly covered with aphids. I should estimate that on an average 29 to 30 per cent of the crop was in this state. These plants being so miserably stunted are unnoticed, except in open bare spots and no suspicion is aroused as to the extent of the injury. The taller and healthier plants were all free or practically free from the pest.

At Turkawlia, in the Chumparan district, where there was plenty of rain in May, I found no traces of the aphid itself, but observed on stunted plants the remnants of the cast off skins of the aphids. These occurred on the stunted plants, which had their vitality so much sapped that despite the rain they were unable to recover thoroughly.

I am unable to recommend the use of kerosene emulsion for several reasons, the most important being that the infested plants are overshadowed by their healthier neighbours; they would therefore be but imperfectly sprayed. There would besides be a great wastage of the emulsion owing to the greater part of it being sprayed on the healthier plants. I observed that the aphid was attacked by at least two insects. First, by the larvæ of a species of Diptera, probably of a species of *Syrphus*. I was unable, however, to rear it. These did not appear to be present in any great numbers and appeared to do but little in checking the aphid.

I also observed the ladybird *Chilomenes sexmaculatus* Fabr. in fair numbers. They appear to check the aphids to an appreciable extent, but at most are only a partial remedy. I was unable to obtain any hyperparasites on this beetle, but suspect their presence owing to the comparatively few ladybirds as compared with the enormous number of aphids.

Last year the aphid appeared on an experimental plot of indigo in the Museum compound. The aphids were present in large numbers but were completely exterminated in two or three days by the larvæ of the ladybird *Chilocorus nigritus* Fab. I have every hope that this ladybird, which usually feeds in Calcutta on the coccid *Chionaspis* (*Hemichionaspis*) *minor*, will prove an important factor in reducing the ravages of this destructive aphid. I was unable to find this ladybird in Behar, even though I examined several colonies of *Chionaspis minor*, to see if this ladybird was to be found in the indigo districts. I am at present experimenting with them and hope in time to be able to send up several colonies of this ladybird to Behar. Due precautions will be taken to avoid any hyperparasites being sent as well.

The *Indigo Thrips.*

In April I received some wingless young and winged adults of a species of thrips which was reported to be eating away the epidermis of the leaves of indigo at Dalsingsarai. In May I had an opportunity of observing the insect at work. The damage done is peculiar and the presence of the insect can be detected by the whitish appearance of the indigo leaves caused by the insect eating away the epidermis of the leaf.

The wingless young were present in very large numbers. The greater proportion of the plants attacked were stunted and a fair percentage of the leaves (about 50 per cent.) of infested plants were attacked. There were on an average from 6 to 12 insects on each leaflet. The wingless young are semi-transparent, slightly reddish in colour. The legs almost colourless. As the insects are so minute it is impossible to examine them properly without a fairly powerful hand lens.

The adult insect is winged, blackish in colour, abdomen pointed, length about $\frac{1}{25}$th of an inch. They are extremely active and take flight on the slightest provocation. It is therefore no easy matter to observe them unless extreme caution is observed on approaching a plant.

These insects have a habit of moving their bodies in an extremely aggressive way which would cause most people to imagine that they are able to sting.

When at rest the wings are laid flat on the back.

The best way to obtain specimens is to use a small camel hair brush moistened with spirit. If used with care the insects can be caught on the tip and transferred to a phial of weak spirit.

Examined under a microscope the four narrow wings fringed with long hairs can be observed.

As regards the damage done, the insect though small does a deal of injury owing to its immense numbers.

I have been unable so far to discover any sort of parasite on this minute insect.

Later I hope to be able to publish a more detailed paper on these pests. I have, however, deemed it advisable to write this short note upon these observations made during my tour to call the attention of planters to these pests.[1]

[1] For various reasons I was unable this year to rear the ladybird *Chilocorus nigritus* Fabr. in Calcutta. There would have been difficulties, however, in propagating this ladybird in Behar, owing to the almost total absence of the Indigo Aphid in the Indigo districts this year.

7. INSECTA INDICA II.

COLEOPTERA 2. NOTES UPON THE KNOWN PREDACEOUS COCCINELLIDÆ OF THE INDIAN REGION, PART I.

BY THE EDITOR.

In the following papers I propose to describe shortly some of the at present known predaceous *Coccinellidæ* (Lady-bird beetles) of the Indian Region. It is a well-understood fact amongst Economic Entomologists that a thorough knowledge of the life-histories and habits of these most useful insects is a *sine qua non* to those who wish to place themselves in the position of being able to combat and reduce widespread attacks of certain classes of insect pests. In this Part a list of sixteen species belonging to eleven genera which are known to be predaceous upon various aphids and scale insects in the Indian Region will be considered. I trust that their tabulation here will lead to a greater number of species being reported in the near future.

Genus ***Hippodamia.***

Chever. Dej Cat. (*typ.* 13-punctata).

Claws bifid, thorax subtransverse, slightly emarginate in front, base rounded, sinuate inside the posterior angles, not margined; elytra alutaceous, with an obsolete punctuation, abdominal plates entirely absent, incomplete externally or (exceptionally) complete.

1. ***Hippodamia variegata,*** var. ***Doubledayi,*** Muls.

(Plate III, figs. 1, 1*a*, 1*b*.)

Predaceous upon *Aphis* sp. The Peach Aphis.

Beetle ♂.—Head white, edged with black behind, the edging being continued round on either side of prothorax to where it meets the elytra. Latter only slightly rounded at base; dorsally a short longitudinal white line with white dot on either side of it. Elytra longer than wide, orange-yellow. A large black patch in basal exterior angles. A diamond-shaped spot above scutellum which is joined to a large central half-moon shaped blotch, placed near suture, by a narrow band running down the suture. These median blotches joined by a narrow band to another on each side placed more laterally and anteriorly. A small black spot above median blotches near suture. A large black semi-elliptical spot in inner apical angles. Long. 4—5 millim. Pl. III, fig. 1 *a*, shows ♂ beetle, nat. size and enlarged.

♀. Larger than ♂; colour of elytra canary-yellow. The exterior asal and interior apical blotches smaller and not so near the elytral margins. No band connecting diamond-shaped patch with the central inner patches. These latter uniform in shape and placed more

laterally and about ⅓rd from apex. The two spots above these smaller and not so close to suture. Long. 5·1 millim. (Fig. 1*b*.)

Larva.—Head orange with four longitudinal dorsal black stripes radiating outwards. Ground colour of body white all over. Third segment orange. Four black spots placed transversely on dorsal surface of each segment forming four rows of dots running longitudinally down the dorsal surface of the body, the two middle rows being close together with a wide space between them and the outer ones. Under-surface white. Described from living specimens on 12th May 1902. Long. 8·2 millim.

Pupa.—Before pupation the larva attaches itself by its anal extremity to a leaf and remains projecting outwards at an angle from the point of attachment, the body slightly curved over, dorsal surface convex, ventral one concave. The pupa is greyish black in colour in its first stage, becoming bright yellow when the larval skin splits down and shrivels back disclosing the true pupa. Below the yellow the orange-yellow forming elytra can be seen beneath the pupal skin; some black spots in pairs upon the dorsal surface of the head and thorax. The suture between thorax and future elytra is plainly marked; four rows of black dots run dorsally down abdominal segments, the two innermost being the largest; two large black spots placed medianly and dorsally between the elytra swellings. Long. 5·2 millim. Pl. III, fig. 1, shows a pupa on a leaf.

Distribution.—Dehra Dun plateau, North India. Elevation 2,000 feet (mihi).

Life-History.—The insect was taken in all its stages by the writer on the 12th May. It was engaged in actively feeding upon a green aphis which was committing serious damage to some young peach trees on the Dun plateau. The Hippodamia was accompanied by *Cœlophora sauzeto*, *Chilomenes sex-maculata*, and *Brumus suturalis* (all described below) which were also predaceous upon the Aphis although they were not as common as the coccinellid under consideration. The description of the method of feeding of the larva and adults given here will stand for any one of the other three species, whose stages were also observed.

The larvæ devour both wingless and winged forms. One grub watched consumed seven aphids successively, springing upon the small insects, seizing and holding them with its anterior pair of legs, and then sucking them dry. The skins are apparently swallowed as well as the contents as no trace of these latter could be found in the box in which a number of the coccinellid larvæ were fed. In the case of the winged forms the wings were the only portions rejected. The

larvæ when feeding do not attach themselves to the leaf by the tips of their bodies as is the habit of *Vedalia guerinii* described later on. The grubs are parasitised by minute insects, perhaps hymenopterous, round holes being observed in several dry larval skins, the larva having apparently reached the first stage of pupation before succumbing to the parasite.

The beetles are very active and run quickly over the curled up and aborted shoots and leaves of the plant searching for the aphids. Every little nook and cranny is visited, since it is in these that the blights are to be found. When an insect is discovered they seize and suck out its contents much in the same way and with the same voracious eagerness as the larva. The beetles were pairing when observed between the 12th and 15th May. They and the *Brumus suturalis* were by far the most plentiful of the four genera present.

2. *Hippodamia constellata,* Crotch.

Crotch, Rev. Coccinell. p. 97. 1874.
Coccinella constellata, Laich. Ins. Tyrol. I. 121. 6 (1781).
„ *mutabilis, Scriba J. F. Ent.* I. 183. 141 (1790).
Adonia mutabilis, Muls. Secur. p. 39. 1.
„ *Doubledayi, Muls. Spec.* p. 38. 1. (T).
Hippodamia ripicola, Muls. Mon. p. 13. 10. (1866) T.
Adonia corsica, Reiche Ann. fr. II. 299 (1862).
„ *bifurcata, Muls. Mon.* p. 28. 3.
„ *Kriechbaumii, Muls. Mon.* p. 30. 4.

(Plate III, fig. 2.)

Predaceous upon *Chermes abietes-piceæ* Steb. MS. and the Blue pine Aphis.

The *beetle* is generally recognisable by the pattern of the thorax which is margined at the sides and in front with white, the anterior margin emitting a sharp tooth in the middle, and two small discal dots, one on either side, also white. The elytra are rather pointed at their apices with three black dots placed laterally on their basal halves and another two anteriorly with a narrow black streak in the inner apical angles. In a variety the anterior two-thirds of the elytra is occupied by a design like a reversed gamma with a small dot on either side of it. Long. 7 millim. Fig. 2 shows beetle, natural size and enlarged.

Distribution.—Common in the N.-W. Himalayas, May to June, at elevations 7,000—9,000 ft. (mihi).

Crotch gives the distribution in the Indian Region as India, Central Asia.

Life-History.—In May and June 1901 and 1902 the writer found this beetle in some abundance upon spruce, silver fir and blue pine trees in the Jaunsar Hills, N.-W. Himalayas. The insects

were feeding, in company with *Coccinella septem-punctata*, upon the eggs and young larvæ of a chermes, *Chermes abietis-piceæ*, which infest the spruce and silver fir and they also probably feed upon a black Aphis which is to be found on the blue pine.

Nothing further appears to be known about its life-history in India. As the species is widely distributed from Europe to Africa and Siberia in addition to Asia and India, it will probably be found that it attacks and feeds upon a variety of *Aphidæ*.

Genus *Coccinella.*

Linn. Syst. Nat. ed. I. 1735 (typ. 7-punctata).

Claws with a basalar tooth. Mesosternum entire. Margins of abdominal segments curved so as to meet in middle, but inclined at sides so that segments are visible. Prothorax prominent in front, semi-elliptical, with a flat base. Elytra slightly wider than prothorax and about three times as long; oval truncate more or less convex.

3. Coccinella septem-punctata.

Coccinella 7-punctata, Linn. Syst. Nat. p. 365. 8 (1758).
" " Muls. Sécur. p. 79. 3 (1846).
" divaricata, Oliv. Ent. VI. p. 1001, 21, pl. V. 67 (1808).
" " Muls. Spec. p. 112, 21 (1850).

(Plate III, fig. 3)

Predaceous upon *Chermes abietis-piceæ* Steb. MS. and Aphis? sp. (Blue pine Aphis).

Beetle.—Head black with two dorsal white spots. Prothorax black with a white patch in exterior basal angle on both sides. Elytra red, a white spot on either side of the scutellum and a largish black spot below it. Each elytron has three other spots—one placed medianly and the other two laterally about a $\frac{1}{4}$th and $\frac{3}{4}$ths respectively from the abse and near the outer angle. Long. 6·5—7·3 millim. Fig. 3 shows beetle, natural size and enlarged.

Distribution.—Crotch gives India. Gorham informs me that the insect has been recorded from the Himalayas as well as from lower elevations in Central and Southern India.

Jaunsar Hills, N.-W. Himalayas. Elev. 7,000—9,500 ft. (mihi). The Indian Museum has specimens from Afghanistan, N.-W. Himalayas, Sikhim, Mungphu, Murshidabad, Birbhum.

Life-History.—The remarks already recorded above for *H. constellata* apply equally to this insect, since the two were invariably found in company in May and June. The *Coccinella*, however, was also found up to the middle of July in the Jaunsar Hills, being present there, upon *Quercus semicarpifolia* in addition to the conifers. Its food is probably very varied since it ranges from Europe to N. Africa and Siberia.

Genus *Cœlophora.*

Muls. Spec. p. 390 (*typ.* inæqualis).

Epistome simply toothed. Antennæ with a long and slender club, the 9th and 11th joints generally longer than wide. Prothorax arched and hardly turned up behind; ordinarily obliquely cut. Scutellum generally wider than long, ending in a point. Elytra usually rounded posteriorly. Body sub-hemispherical.

4. *Cœlophora sauzeti* Muls.

(Pl. III. fig. 4, 4*a*.)

Predaceous upon *Aphis* sp. The Peach Aphis.

Beetle.—Ground colour canary yellow. Head, antennæ and legs same colour. Thorax black with a yellow triangular patch on anterior outer angles. A black line running down elytral suture expanding nto a circular spot in centre and near the apical ends of the elytra. In addition there are two other circular black spots on each elytron placed laterally, the one near the outer basal extremity, the other in the upper half. Ventral surface black. Length 4·1 millim.

Described from living specimens. Fig. 4*a* shows this beetle natural size and enlarged.

Larva.—Head black, first three segments black with a yellow spot on their dorsal surfaces, small on first, larger on the other two. A yellow edging between head and first segment of the body, this being continued down the sides of first three segments. Rest of segments black, the seventh and eighth having a series of yellow dots running transversely from one side dorsally to the other, largest in centre. A yellow transverse patch in centre of dorsal surface of the ninth, tenth and eleventh segments and one at the sides of each of the fourth and fifth. Legs black. Ventral surface black with a broad yellow elongate stripe running right down the centre. Described from living species taken in the middle of May. See Pl. III. fig. 4.

Distribution.—Dehra Dun plateau, North India. Elevation 2,000 feet (mihi).

Life-History.—Both larvæ and beetles were taken between the 12th and 15th May. The insect in both stages feeds actively upon a small aphis which infests the peach in the Dun plateau in Northern India. The larvæ devour both larval and winged forms of the aphis, whilst the beetle seems to prefer the wingless larval forms.

Genus *Synonycha.*

Chev. Dej. Cat. p. 460 (*typ.* Grandis).

Distinct by the bifid claws; punctuation fine, elytra not margined, scutellum impunctate.

5. Synonycha grandis.

Coccinella grandis, Thumb. Nov. Sp. Ins. p. 12. f. 13.
Synonycha grandis, Muls. Spec. p. 230. 1.

(Pl. III. fig. 5.)

This is the largest species of the family known.

Large, oval, orange-coloured, shining; very convex above, resembling a tortoise in shape. Head black. Thorax yellow-white a basal median circular black spot occupying larger part of lower half. Elytra crescent margined at their bases with in all 8 spots on each. One just above centre of basal margin on either side, two more on contour of outer margin $\frac{1}{3}$rd and $\frac{2}{3}$rds, respectively, from outer basal angle, two more directly above the first mentioned, about $\frac{1}{2}$ and $\frac{3}{4}$ up, two median ones joining to form a triangular blotch about $\frac{1}{3}$rd up median suture, two more much smaller $\frac{5}{6}$ths up median suture with a small one at each apex. Legs orange-yellow. Long. 12—13 millim. Fig. 5 shows the beetle.

Distribution.—India; Ceylon.

Indian Museum possesses specimens from Mungphu (Sikhin), Manipur, Dikrang Valley, Calcutta, Andaman Islands and Upper Tenasserim.

Genus *Palæoneda.*

Crotch, Cat. Cocc., p. 5. (*typ.* auriculata).

Clypeus semi-circularly emarginate; thorax with the sides nearly straight; anterior angles extremely acuminate, above deeply impressed, prosternum compressed, mesosternum emarginate, also compressed, together with the base of the metasternum, which is united to the preceding by an imperceptible suture; elytra not thickened at the margin, epipleuræ very broad, not foveolate, not acuminate at the apex; antennæ with the first joint triangularly dilated. Scutellum very small.

Distribution.—Northern India (Crotch); Madras Presidency.

Palæoneda sex-maculata.

I. M. N.—Previous refererce. I, 1, p. 64.

Predaceous upon *Aulacophora abdominalis* Hope.

Beetle.—Canary to orange-yellow, long-ovate. Prothorax elliptical, with a median transverse crescent-shaped black mark and a posterior one on edge ending on either side in a black blotch. Elytra with a black mark like a reversed C on basal two-thirds and a black spot near upper anal corner. Long. 4·3—4·5 millim.

Distribution.—Ganjam District, Madras Presidency (Collector of Ganjam, 1888).

Life-History.—In September 1888 the Collector of Ganjam forwarded to the Museum specimens of beetles reported to destroy cotton, red gram, and cucumber. The insects proved to be the chrysomelid beetle, *Aulacophora abdominalis* and the coccinellid *P. sex-maculata*. This latter beetle is probably predaceous upon the former.

Nothing further appears to have been reported on this insect.

Genus *Chilomenes*.

Chevr. Dej. Cat. p. 459 (*typ.* lunata).

The clypeus is semi-circularly emarginate, the antennæ short, the elytra not margined and at least $\frac{1}{6}$th wider in front than the prothorax; posterior edge of latter moon-shaped, the outer angles directed backwards, the outer angles of the elytra being directed forwards. The abdominal plates V-shaped.

7. *Chilomenes sex-maculata*.

Coccinella 6-maculata, Fabr. Sp. Ins. I. 96, 20 (1781) T.
Cheilomenes 6-maculata, Muls. Spec. p. 444, i.
Crotch, Rev. Coccin. p. 180. 1874.
I. M. N.—Previous reference. III. v. 55.

(Plate III, fig. 6.)

Predaceous upon *Siphonophora scabiosæ* Schrank, Aphis sp. (Peach Aphis) and Aphis sp. (Indigo Aphis). Aphis sp. (Juar Aphis).

Beetle.—About the same size, perhaps a shade larger than *Coelophora Sauzeti*. Oval. Head and thorax canary yellow, eyes black. A short transverse black line across centre and a curved one edging the posterior margin of the prothorax. Elytra orange yellow, a black stripe running down the suture. An irregularly crescent-shaped mark near the basal margin of each. Below this at about the centre an irregular zig-zag transverse black line not meeting either edge of elytra, and below this a black spot near apical margins. Ventral surface orange red and antennæ dark yellow. Female is much larger than the male and lighter in colour. Colour variable to dark orange. Long. ♂ 4·5, ♀ 4·5—5·2 millim. Fig. 6 shows this beetle, natnral size and enlarged.

Distribution.—Said to be common throughout the Indian region. Reported from Calcutta (Sibpur). Dehra Dun plateau, North India Elevation 2,000 ft. (mihi) and Dalsing Serai, Behar (H. W. Peal).

Indian Museum Collections contain specimens from North India, Calcutta, Ranchi, and the Andaman Islands.

Life-History.—In Calcutta beetles were reared from larvæ sent to the Indian Museum in February 1894, adult insects being obtained on the 17th and 19th of the month. It is thus evident that the pupal stage of this generation of the insect is a short one. The larvæ were reported to be feeding upon *Siphonophora scabiosae* which had attacked and were ruining tobacco leaves in the Sibpur Experimental Farm.

In the middle of May 1902 the writer obtained pupæ and adults on the Dehra Dun plateau. The beetles were discovered feeding with great avidity upon an aphis which was attacking and destroying the foliage of young peach trees. In this case it was noted that about 7 days were spent in the pupal stage. It is not at present certain whether this is a second generation of the insect in the year, or whether, owing to the much colder climate in North India, the insects found were in their first generation. The latter is considered the most probable. The beetle is excessively voracious. The writer discovered one attempting to feed upon the pupæ of *H. variegata* var. *doubledayi* (described above). It seized the pupa with its fore and middle pairs of legs and endeavoured to bore through one of the dorsal abdominal segments. The pupa wriggled its body actively backwards and forwards using its point of attachment to the leaf as a fulcrum. The beetle, though with difficulty maintaining its position under this motion, clung to the pupa and would probably have killed it had not the writer interfered. The Asistant Entomologist, Mr. Peal, found it, as will be seen from his report on p. 45, feeding upon the Indigo Aphid in Behar.

This beetle was found finding upon a species of Aphis which attacks Juar at Lyullpur, Punjab in September of this year (1903).

Genus *Chilocorus.*

Leach. Edin. Ency. IX. p. 116 (*typ.* cacti).

Spread over the whole world. Head perpendicular or inclined. Antennæ short, hardly as long as the width of the forehead, with a fusiform club. The sides of the thorax are nearly always pubescent.

Thorax black, elytra unicolorous black, or metallic or spotted with red. Legs hidden beneath body in repose; claws furnished with a basilar tooth.

8. Chilocorus nigritus.

Coccinella nigrita, Fabr. Suppl. Ent. Syst. p. 79 (1798).
Chilocorus nigritus, Muls. Spec. p. 463, 14.
Orcus cerberus, Muls. Op. VII. p. 148 (1846) T.
Crotch, Rev. Coccinell. p. 184, 1874.
I. M. N.—Previous reference. *Chilocorus nigrita, Fabr.* in v. 3, 129, Plate ix. Figs. 2, 2*a*, 2*b*.

Predaceous upon *Chionaspis* (*Hemichionaspis*) *minor*, Maskell. Aphis sp. (Indigo Aphid).

Beetle. Body hemispherical, shining above. Head yellowish-red or testaceous. Prothorax rounded with straight sides furnished with light coloured fine and scattered hairs; shining black above, reddish or reddish yellow at sides. Scutellum black. Elytra very convex, slightly less so anteriorly, of uniform width and shining black in colour, which is sometimes less deep at the exterior edges. Faintly punctuate without deeper punctures at the margin. Body beneath and legs reddish-yellow or testaceous; tibiæ obsoletely armed. Long. 3·2—3·5 millim.

Larva.—Although the larva is figured in Indian Museum Notes no description of it or the beetle appears to have been made at the time.

Distribution.—India, Malabar (Fry), Sibpur, Calcutta (Prain).

Indian Museum Collections possess specimens from Calcutta, Mungphu (Sikhim), and Madras.

Life-History.—The insect feeds upon the coccid *Chionaspis minor* in its larval state. It was so found by Major Prain, I.M.S., at the Botanic Garden, Sibpur, in March 1900. It has also been found feeding upon the Indigo Aphid by Mr. Peal (*vide* p. 45 *ante*).

9. Chilocorus circumdatus.

Coccinella circumdata, Schön. Syn. Ins. II. 152 (1808).
Chilocorus circumdatus, Muls. Spec. p. 454, 2.
Chilocorus nigromarginatus, Mots. Et. Ent. VIII. 170.
Crotch, Rev. Coccinel. Lond. 1874.
I. M. N.—Previous references. II. 6, 154; IV. 4, 218.

(Plate III, fig. 7.)

Predaceous upon *Lecanium coffeæ*. The Brown Bug.

Beetle.—Body sub-hemispherical, very convex; dotted; red or reddish-yellow; shining above. Eyes black. Prothorax rounded at sides and finely margined, the posterior fold visible. Elytra very convex margined and with a black edging. Of a uniform width or very slightly wider at the apical angles. Beetle evidently and rather closely punctulate.

Var.—Punctuation fainter and more obsolete, elytra less visibly margined.

Distribution.—Ceylon (Schaum), Neilgherries (Guérin).

Life-History.—The insect is said to feed upon the brown bug, *Lecanium caffeæ*, of coffee and is therefore of considerable use upon coffee estates. It was reported in this connection from Ceylon by Nietner.

The figure shows some empty larval skins upon a piece of stem drawn from a specimen kindly lent me by Mr. Green.

Genus *Brumus*.

Muls. Spec. p. 492 (*typ.* 8-signata).

Front legs plain. Hood truncate or slightly arched inwards in front. Prothorax only slightly arched and without sinuosity at its base; sides nearly straight. Elytra convex simply margined not hiding the thickness of the thighs. Abdominal plates simply arched. Body oval.

10. Brumus suturalis.

Coccinella suturalis, Fabr. Suppl. Ent. Syst., p. 78 (1798).
Brumus suturalis, Muls. Spec., p. 494, 2.

(Plate III, fig. 8.)

Predaceous upon Aphis sp. (Peach Aphis).

Beetle.—Oval, convex, not distinctly dotted; shining above. Head, antennæ, and palps reddish-yellow. Prothorax feebly arched in front, more prominently so behind, the arc being directed backwards; reddish yellow without spots. Scutellum black. Elytra satiny white with thin black longitudinal stripes running down them, a sutural one and one on each elytron; elytra leave the last segment of the body exposed, this being reddish brown. Ventral surface red with black patches between the legs and on the first segment of the abdomen. Legs red, with posterior femora marked with a mediam black patch. Long. ♂ 3-5, ♀ 4 millim. Fig. 8 shows the beetle, natural size and enlarged.

Distribution.—Crotch gives this as India.

The Indian Museum Collections contain a specimen marked Madras. Also specimens from the Dehra Dun plateau, North India. Elevation 2,000 ft. (mihi).

Life-History.—The writer took this beetle between the 12th and 15th May 1903 plentifully on peach trees which were badly attacked by an Aphis. The coccinellid was feeding upon the blight, it being the fourth and smallest of the species discovered at the time. It was quite as abundant as the Hippodamia already described. The

Brumus is an active beetle running rapidly over the plant when in search of its prey. It feeds voraciously. Some beetles were kept in a box for 24 hours without food and then some aborted peach shoots and leaves containing aphids were placed inside. The beetles at once showed the greatest excitement running quickly over the mass and over each other in their eagerness to get into the interior of the curled-up contorted mass. Every nook and cranny was visited by the small insects and they cleared off the whole of the blight in an incredibly short space of time. The beetles were pairing at the time of capture, the insects remaining coupled for several hours. The male which is the smaller of the two mounts on to the back of the female.

Genus *Platynaspis.*

Redtenb, Tentamen., p. 11 (*typ.* luteo-rubra).

Prothorax not covering the head. Epistome forming with the cheeks a hood which hides the antennæ and the greater part of the eyes. Elytra scarcely wider in front than the thorax. The thighs do not hide the shanks when the legs are drawn back.

Crotch thinks that this genus is better placed in the Chilocorides than in the Scymnides; the pubescent surface not being a character of a high order.

11. Platynaspis luteo-rubra.

Crotch. Rev. Coccinell, p. 196, 1874.
Coccinella velue ā points, Geoff. Hist. Nat. 1. 322. 22. (1762).
Coccinella luteo-rubra, Goeze, Ent. Beyt. 1. p. 247 (1878).
Coccinella villosa, Fourc. Ent. Par. 1. 149. 22 (1785).
Platynaspis villosa, Muls. Sécur. p. 216. 1 (1846).
Scymnus spectabilis, Fald. Mém. Mosc. V. p. 410 (1837.)
I. M. N.—Previous reference, *Platynaspis villosa*, III. 5, 50; V. 3, 63. Pl. IX, fig. 3 (imago).

Predaceous upon *Chionaspis decurvata* Green and *Icerya. ægyptiсum* Douglas.

Beetle.—Elongate-ovate, sub-depressed with a thorax rounded behind. Head orange, antennæ short. Elytra dark brown with an orange tinge. A large orange patch on basal half of elytra and a smaller round one in apical angle. Legs orange brown. Long. 1·3—1·5 millim.

The larva is a brownish grub which transforms into a pupa attached to a twig of the plant upon which the grub was feeding.

Distribution.—Calcutta.

Life-History.—This insect was found in all its stages from larva to adult in July 1900. It was feeding upon *Chionaspis decurvata*

which had attacked the leaves of rice plants grown under shelter in the Indian Museum compound. The coccinelled feeds upon the scale in both its larval and adult stages of life.

Genus *Symnus.*

Kugell Schneid. Mag. 10 (1794), (*typ.* frontalis).

Folds of the elytra not deeply pitted. Antennæ very short, hardly reaching ¼th down prothorax; 10-jointed, joints 1-2, equal-sized, soldered together.

12. Scymnus rotundatus.

Scymnus rotundatus, Mots. Et. Ent. VIII. p. 170 (1859).

I. M. N.—Previous reference, I. 6, 154; IV. 4, 218.

Predaceous upon *Pseudococcus adonidum.*

Sub-hemisphæricus, subtilissime dense punctulatus, brevissime cinereo-puberulus niger; ore antennis pedibusque rufo-testaceis, femoribus abdomineque infuscatis; corpore subtus nitido, punctato; thorace valde transverso, antice arcuatim angustato, angulis posticis subrectis; scutello minutissimo, triangulari; elytris ad basin thoracis latitudine, arcuatim dilatatis, rotundatis, humeris indistinctis.

Near *S. ater*, but more rounded, without humeral angles. Abdominal laminæ triangular. L-¾ lin.

Distribution.—Ceylon.

Life-History.—This beetle was reported some years ago by Nieter to feed upon the white bug of coffee bushes, *Pseudococcus adonidum*, in Ceylon. Nothing further appears to have been observed in its life-history.

13. Scymnus sp.

I. M. N.—Previous reference, III. 5, 50.

Predaceous upon *Icerya ægyptiacum* Douglas.

Beetle.—Yellow to orange in colour, ovate and shining. Head yellow with black eyes. Anterior outer angles of thorax project, the anterior margin being concave, the posterior convex and pointed medianly. Elytra lighter-coloured, covered with a scattered pubescence. Legs orange-yellow. Long. 1—1·1 millim.

Distribution.—Calcutta (Indian Museum compound).

Life-History.—The mature beetle was found sparingly feeding upon the scale insect *Icerya ægyptiacum* in the beginning of June 1894.

Genus ***Vedalia.***

Muls. Spec. p. 905 (*typ.* Sieboldi).

Thorax not margined, punctuation variable, epipleuræ broad, dilated, concave. Antennæ extremely short, hardly longer than the width of the front; form oval; anterior tibiæ less emarginate than in the genus Rodolia which greatly resembles Vedalia; its form is, however, orbicular.

14. Vedalia fumida, var. *roseipennis.*

Rodolia fumida, Muls. Spec. p. 904, 4 (T).
Epilachna arethusa, (Muls.) Op. III, p. 126 (T).
Epilachna testicolor, (Muls.) Op. III, p. 127 (T).
Rodolia roseipennis, Muls. Spec. p. 904, 5 (T).
Rodolia chermesina, Muls. Spec. p. 905, 6 (T).
Crotch. Rev. Coccinell., 1874.
I. M. N.—Previous references, IV. 1, 27; 4, 218.

(Plate III, fig. 9.)

Predaceous upon *Icerya ægyptiacum* Douglas and *Monophlebus stebbingi* Green.

Beetle.—The punctuation is very fine and uniform, the colour yellow and the general form oval. Mulsant redescribed it in 1853 as an *Epilachna*; *Rodolia roseipennis* is an immaculate form. Long. 3 millim. Fig. 9 shows this beetle, natural size and enlarged.

Distribution.—India, Bengal (Deyrolle); Dehra Dun plateau, Northern India (mihi).

Life-History.—Beetles were reared in the Indian Museum in July 1894 from a batch of pupæ obtained from ornamental bushes in the Museum compound. Both larvæ and beetles feed upon the scale insect, *Icerya ægyptiacum.*

The insect was found by the writer in April 1902 feeding upon the scale insect *Monophlebus stebbingi* in company with *Vedalia guérinii*, the latter being by far the most numerous of the two. Only the adults of the *roseipennis* were taken, though it is probable that larvæ were also present upon the sâl trees upon which the Monophlebus was feeding.

15. Vedalia Guerinii.

Crotch, Rev. Coccinell, p. 282, 1874.
Coccinella sp. *Steb. Dep. Not. Ins. For.* 2, 324.

(Pl. III, figs. 11, 11*a*, 11*b*, 11*c*, 11*d*.)

Predaceous upon *Monophlebus stebbingi* Green.

Beetle.—Subovate, rather shining, finely and uniformly punctulate, red; head, base of thorax, and elytra each with three spots (2 placed transversely at the base, 1 large, occupying the posterior third), black; thorax formed as in *Chilocorus*, broadly rounded behind, sides produced, narrow, rounded; tibiæ compressed, externally setose. L. 6·2 millim. When ready to issue the pupal skin splits down dorsally and ventrally at the anterior end and the beetle crawls out. Fig. 11*d* shows the beetle, natural size and enlarged.

Larva.—When young the larva is long, narrow and black. It retains this colour during its first two moults. As it grows older the markings change to white and black or reddish with white markings, or greyish purple. When full grown the head is well developed, narrower than the following 10 segments of the body. Of these latter the middle ones are broadest, the grub tapering to either end. These segments project laterally into pointed teeth, giving a serrate edged appearance to the grub. On each of the 10 segments there are four dorsal tubercles, two on each side. The last two segments taper, are reddish-black in colour, the last one ending in a sucker pad-like apparatus which forms the end of the body and which is very adhesive. The arrangement of the segments render the body extremely pliable and the larva can almost roll itself up into a ball. Ventral surface same colour as dorsal but has no tubercles. Just before pupating the larva often changes from the white and black or greyish purple colour to a brick red. Long. 8·2 millim. Figs. 11, 11*a*, show the larva, dorsal and side view (enlarged).

Pupa.—The pupa is attached to a leaf or twig, the larva fixing itself in this position before pupating by means of the adhesive pad at the end of its body; it remains projecting outwardly at an angle from the point of attachment; dorsal surface convex, ventral concave. After 24 hours the larval skin splits down anteriorly and the bright red spherical pupa is disclosed. In the pupa the small black eyes of the future beetles, the developing wings and the dorsal ridges of the abdominal segments are clearly distinguishable under the skin. Colour varies from bright to dull red, crimson lake or orange red. Size about 6·2 millim. Figs 11*b*, 11*c* show the pupa side and dorsal view.

Distribution.—Pondicherry (Guérin); Dehra Dun plateau, Northern India (mihi).

Life-History.—The insect was found by the writer in all its stages of larva, pupa and adult in the middle of April 1902, up to the end of that month and on into the first week in May when, having laid its eggs, it disappeared. Both larvæ and beetles were actively engaged in feeding upon the large white scale insect *Monophlebus stebbingi* which was swarming in the sâl forests of the

Dun plateau. 8-9 days is the length of time spent by the Vedalia in the pupal stage, adults issuing on the 24th and 25th from pupal cases of larvæ which had pupated on the 16th. Numbers were bred out and this period seems to be fairly constant for the April generation. The beetle appears to pass some days feeding upon the scale before pairing and egg-laying. The ♂ dies within 24 hours of pairing with the ♀.

The grub is very active and eminently voracious. When it has found a scale (the insect being often twice or thrice its own size) it rushes precipitately at it, fixes its mouth parts into the soft body substance and at the same moment attaches itself by means of the adhesive pad at the extremity of its body to the twig. The struggles to escape of the larger and much heavier scale are quite futile. The larva feeds by sucking out the juicy body contents of its host. Grubs watched were found to spend as much as 8 hours in continuous suction at one scale, only quitting it when nothing but an empty dry wrinkled black skin was left. The amount of material they are able to absorb at one meal is very large. The larvæ are not gregarious.

The pupæ are to be found fixed either to the upper or under side of the leaves or to the twigs and they are usually found in groups together. The beetles are very gregarious and pass the heat of the day collected thickly together on the under surface of large leaves. They also feed upon the scale but only absorb a comparatively small portion of its body contents at a time and never kill it outright. Little yellow marks are left upon the scale showing where they have been previously 'tapped' by the Vedalia adults, several of these latter being often found fixed to the same scale. The writer has only as yet obtained this spring generation, though it is not impossible that more than one generation may be passed through by the coccinellid between March when the larvæ first appear in the Dun and the first week in May.

For a fuller account of what is known upon the life-history of the Vedalia see the writer's Departmental Notes on Insects that affect Forestry No. 2, pp. 324-331.

16. Vedalia discolor.

(Pl. III. fis. 10, 10*a*.)

Beetle—Oval, very convex, small, yellow in colour with a white pubescence. Prothorax with posterior margin triangular. Elytra project slightly beyond prothorax, convex. Long. 4·5 millim.

17 Vedalia ? sp.

(Pl. III, figs. 12, 12*a*.)

Predaceous upon *Monophlebus stebbingi* var. *mangiferæ*.

Larva.—Not unlike *V. guérinii* larva, but larger. Spirit specimens a dull reddish purple tapering anteriorly and posteriorly. Mouth parts blackish; three pairs of long stout black legs on the three segments following the head; 4 rows of tubercles on dorsal surfaces of the segments, running longitudinally down the body. Segments produced laterally into a pointed process giving a serrate side to the larva. Larva is thickest in the middle, being very convex dorsally and flat beneath. Length 10 millim. Figs. 12, 12*a* show a dorsal and side view of the larva (enlarged).

Distribution.—Shalimar Gardens, Lahore, Punjab.

Life-History.—In May 1902 Mr. Beadon-Bryant, Conservator of Forests, forwarded some scale insect from the Shalimar Gardens, Lahore, with the note that they were injurious to mango trees. The scales proved to be but a variety of the Sâl *Monophlebus* (*vide* p. 63). In view of the presence of the predaceous *Vedalia guérinii* upon this latter scale the writer asked for further consignments of insects from Shalimar this year (1903), and also that a search might be made in the plantation for ladybird beetles and their grubs. At the instance of Mr. Beadon-Bryant, Mr. Blascheck, Assistant Conservator of Forests, sent a further consignment of specimens in May. With the full-grown female scales a number of large larvæ not unlike the *V. guérinii* larvæ, but larger and thicker, were received. The writer has little doubt that these were predaceous upon the female Monophlebus scales.

NOTES ON INSECT PESTS FROM THE ENTOMOLOGICAL SECTION, INDIAN MUSEUM.

By the Editor.

I.—Insect Pests of Fruit Trees.

Insects infesting the Mango (*Mangifera indica*).

1. Monophlebus stebbingi var. mangiferæ Green.

Order, *Rhynchota*. Family, *Coccidæ*.

This insect is one of those scales which in their older stages feed upon the woody parts of shrubs and trees. When full grown the female scale insect is a large, thick, succulent, white coccid, its real yellow colouring being hidden beneath a powdery white mealy substance. It has two antennæ and three pairs of legs. The male is a small two-winged fly having a red body provided with several terminal appendages, no mouth parts and a pair of small black wings in which are a few white streaks. Figs. 5 and 5*c* in Plate xx, Vol. 5, show the female and male insects of *M. stebbingi* of which species the present insect is only a variety. The damage is done by the female insects sucking out the sap of the twigs and branches.

Early in the cold weather in Northern India a careful examination of infested mango trees will show minute yellow objects, the size of a pin-head, clustered round the veins or ribs of the leaves, generally upon the underside. With a lens it will be seen that these little dots of colour are insects, each being furnished with three pairs of short legs, a pair of yellowish feelers or antennæ and each having its proboscis buried in the tissue of the rib of the leaf. These are the young Monophlebus scales which have already begun their attack upon the mango. Some 6 to 8 weeks are thus spent feeding upon the leaves, the insects moving but little during this period of their existence. Whilst in this very minute stage they may be spread about from tree to tree by small mammals, birds, or insects. Whilst feeding the insects pass out copious amounts of a sugary secretion which thickly coats the leaves and twigs with a sticky material; this dries under the sun's rays giving the leaves the appearance of having been varnished. In fact the scales are little more than animated siphons, the sap from the leaves passing through their bodies in a continuous stream which clogs up the transpiration pores of the leaves.

Thus even when quite young the scale has made its presence felt on the tree. The damage is small as yet, since the trees are

not actively growing and the leaves affected are the old ones. Somewhere about February the little scales, which have already shed their first skins upon the leaves, descend to the young twigs and from then onwards till they mature, remain here and on the larger branches. They collect in masses round the twigs, several inches being often densely encircled with the insects, and keep their position till they have drained out most of the sap, and then proceed to a fresh twig upon which they again congregate. It is this power of moving about at will (which is not usual amongst *Coccidæ*) which, added to their enormous fertility, enables these insects to multiply in large numbers and renders them so dangerous. March, April, and perhaps a portion of May are spent upon the twigs and branches, the insects moving down to the latter as they increase in size and at least two further moults of the skin take place. In shedding the skin this latter splits down anteriorly and the insect crawls out. The cast skins are white and papery and will be found sticking to the leaves, twigs, and stems of infested trees, being attached thereto by the sugary secretion. From the minute dot of yellow colour found upon the leaves in the early cold weather the insect will have grown to about $\frac{1}{8}$th inch in size and have changed to dark-orange or orange-brown when quitting the leaves for the twigs, and when about half to $\frac{2}{3}$rds grown it begins to become covered with a dry white powdery mealy substance which can be rubbed off with the finger. The scale will be by now from a quarter to $\frac{1}{2}$ inch in size, elliptical in shape, white and flattish, with ridges and corrugations on its upper surface marking the different segments. At its head end it is provided with a pair of black antennæ and beneath are three pairs of black legs. No further change in appearance takes place, except in size, till it matures towards the end of April or in May when it may be $\frac{3}{4}$ inch long and half this in width. There is no mistaking the insects at this stage, the large white thick puffy-looking scales being most conspicuous, and it is this stage that has been observed in various parts of India upon the mango. The little black winged male pairs with the females at this period and the latter cease feeding soon after fertilization has taken place. During bad infestations of the insects the large white females are to be seen in numbers marching about up and down the trees or clinging in serried masses to the twigs and branches, giving to these latter the appearance of being encrusted with snow. The exudation of the sugary liquid is at this period very heavy and coats leaves, twigs, branches, and drips down on to the trunks and the ground beneath like rain or heavy dew.

The falling-off in the condition of the trees and the non-ripening of the fruits is rightly attributed at this period to the scale, which sucks out the sap from the flower and young leaf-bearing branches and causes them to dry up. The damage done in the earlier stages of the pest has been, however, usually attributed to more easily visible insects which may have been present in the orchard at the time, and it is therefore to these earlier stages that attention must be drawn. In April and May when the mature females are seen walking up and down the trees or upon the ground below they have finished their feeding operations, have paired with the males, and are on the look out for suitable places in which to lay their eggs. The damage to the orchard has been done for that year and all that can be then attempted is to prevent its re-occurrence in the succeeding one. The eggs of the mango variety of the pest have not yet been obtained, but they and the method of egg-laying are likely to closely resemble that of their near relation the sâl monophlebus. In the case of this latter the eggs are laid in a loose white silken net-like sac, over 450 small pink shining eggs being laid by a single female. The insect seeks some crevice in the bark of fallen trees or stems, etc., on the ground to hide beneath, extrudes this silken sac containing the eggs from her body and dies, her dead skin remaining as a partial covering above it.

Remedies.—Three forms of remedies may be recommended, either of which should tend to reduce the numbers of the pest in the orchard :—

1. In the younger stages it would prove useful to spray the trees with kerosene emulsion. This would kill off the young female larvæ on the leaves and twigs.

2. It has been stated that the insects walk about up and down the trees a good deal when approaching their full growth, say, from the middle of March onwards. It is therefore recommended that a broad band, about 2 feet deep, of some sticky material be painted round the trees at a height of 4 feet from the ground. A good material is a mixture of tar and glue as, if properly mixed, it will remain sticky for several months. Any convenient and easily procurable material may be used, it being remembered that the chief essential is that the band should retain its stickiness and be well put on. If the material dries quickly, it must be constantly renewed. This band should be placed upon the trees about the middle of March or earlier if the insects are seen to be walking about. The object of the sticky ring is to entrap all wandering scales. Those endeavouring to cross the band will stick fast and eventually die. The band is, however, more especially useful later on when the scales, having paired

descend the trees in search of suitable places of concealment in which to place their eggs. With good sticky bands upon all the trees it should be possible to capture and kill off a large percentage of these females before they egg-lay. It is very probable that many, when they find themselves entrapped by the band, will oviposit there. It will be advisable therefore to visit the bands fairly often and remove and burn the scale insects sticking to them. In the case of a severe attack this visit should be made daily or the insects might in time bridge the band with their dead bodies over which the living would then cross. In putting on the bands deep furrows or inequalities in the bark should be scraped down so that the sticky substance used may form a *continuous* ring round the tree. This is absolutely essential as any channel left unbanded will certainly be found out and used by the insects to escape the ring. When the attack is over the bands should be carefully scraped off and the scrapings burnt. The reason for this is that each band will almost certainly contain a number of eggs laid by the entrapped females. As long as these eggs remain in the sticky band they are harmless, but it is probable that the monsoon rains would soon wash them out, and many might thus reach a place of safety and hatch out in the ordinary course.

3. The third remedy advocated is to introduce a predaceous lady-bird beetle into the orchard. The beetle and its grub will feed upon the scale and reduce its numbers. To render this method of remedial measure effective, it will be necessary for the owner of the orchard to apply to an expert for help. Before such an application is made, however, the owner should keep a careful watch in his orchard to see whether such an insect is not already present feeding upon the scale. Plate III, figs. 11, 11*a*, 11*b*, 11*c* shows the grub and adult insect of the beetle known as *Vedalia guérinii* which feeds upon the monophlebus of the sâl tree, of which the mango insect is only a variety. It is therefore probable that this insect would feed upon the mango Monophlebus. But this latter scale already has a predaceous coccinellid grub feeding upon it, of which the beetle is as yet unknown. This grub is shown Pl. III, figs. 12, 12*a*.

The mango Monophlebus has been reported from the Shalimar Gardens near Lahore and the Bareilly public gardens. Species, probably identical with it, also from Dalsing Serai (Tirhoot), Darbhangha.

Points in the life-history requiring further study.

(*a*) What becomes of the insect between the beginning of May, after egg-laying has been completed and the male and

female scales have died off, and November or December when the young female larvæ are to be found upon the old leaves of the tree? Is the whole of this period spent in the egg stage, or is there a second stage in the life-history of the insect?

(*b*) Are the scales found upon the mango at Shalimar, Bareilly, Dalsing Serai and Darbhanga identical?

2. *Dinoderus distinctus* Lesne.

Order, *Coleoptera.* Family, *Bostrichidæ.*

(Plate IV, figs. 1, 1*a*. 1*b*, 1*c*.)

A small brownish beetle about $\frac{1}{6}$th inch in length; the thorax and elytra pitted and striated. Front part of thorax almost rasp-like. The antenna has a thin lobed club at the end of it. The shank of anterior leg is spined. Fig. 1 shows a dorsal view, 1*a*, a side view, of this insect enlarged; 1*b* the antenna and 1*c* leg enlarged. A technical description of this insect is given on p. 20.

This beetle was found boring into dying terminal branches of mango trees. Also in newly dead ones. The beetles were found in pairs tunnelling in the branches on the 19th May 1902. The entrance tunnel and a portion at least of the egg-gallery, which runs parallel to the long axis of the branch in the wood, are bored by the two insects together. The gallery is probably finished by the female and the eggs are then laid in it. The larvæ feed in the wood. Several different pairs of beetles were found in separate tunnels in some of the twigs. They appear to invariably bore up the twig.

This is the first report of this species from India. The beetle was found by Mr. F. Swettenham and the writer on the Raynorpur Grant in the Eastern Dun, United Provinces, at an elevation of about 2,000 feet.

Remedy.—Keep the tree as free as possible from dead or dying twigs. Such occur in considerable numbers as the result of severe attacks of the monophlebus scale above described. They should be pruned off the tree and all prunings carefully burnt.

Points in the life-history requiring further observation.

1. The number of generations of the insect in the year.
2. Length of time spent in the grub stage.
3. In which stage is the winter passed through?

3. *Hypothemnus* (?) sp.

Order, *Coleoptera*. Family, *Scolytidæ*.

(Plate IV. figs. 2, 2*a*, 2*b*, 2*c*, 2*d*.)

Beetle.—A minute little beetle brown in colour and $\frac{1}{8}$th inch in length. The antenna is angled and ends in an ovate club. There is no rasp-like surface to the front of the thorax. The elytra do not quite cover the abdomen, the latter being turned upwards beneath. The elytra have parallel rows of pits upon them. Fig. 2 shows a dorsal and 2*a*, a side view of this insect, enlarged. Figs. 2*b* and 2*c* the antenna and leg enlarged. Fig. 2*d* the larva enlarged.

Larva.—Small elongate white with a brownish head and no legs.

This beetle only attacks the green shoots of the mango and bores into and lays its eggs in the green layer beneath the outer bark of the twigs and the sapwood. Its presence can be readily detected owing to the fact that black patches appear upon the green cortex. Above these black patches the leaves on the twig will be seen to be turning yellow and they die and fall off.

The beetles appeared to be just maturing and some larvæ were found in the twigs on May 11th. This was probably the first generation of the year, and it is probable that there are one or two more subsequent ones.

No further notes appear to have been recorded upon this insect, which is new to the British and Indian Museum collections.

It was found in the same trees as the *D. distinctus* above described, and the remedial measures advocated for the latter apply equally to the scolytid. This latter, however, will never be found attacking dead branches.

Points in the life-history requiring further observation.

1. When are the eggs of the first generation laid, *i.e.*, when are the beetles first found attacking the trees in the spring?
2. The number of generations in the year.
3. The number of eggs laid by the ♀ beetle.

4. *Hypomeces* sp.

Order, *Coleoptera*. Family, *Curculionidæ*.

A fairly large stout black weevil. Head with a broad blunt snout, channelled and with a longitudinal median channel running down it dorsally and some scattered white hairs anteriorly. Eyes prominent, black, placed rather far back on either side. Prothorax triangular, truncate, twice as wide behind as in front, corrugated, with a longitudinal median dorsal channel on the anterior half. The thorax is

flattened dorsally in the middle, this flattening being carried on to the anterior portion of the thorax. Latter with a crescent-shaped anterior edge and tapering to a blunt point behind with longitudinal rows of pits on them. Legs black, tarsi yellowish brown. Ventral surface black. Long. ♂ $\frac{9}{16}$th inch; ♀ slightly larger.

This insect was reported from Katha in Upper Burma by Mr. J. Messer, Deputy Conservator of Forests, as being particularly dest tructive to fruit trees and ornamental shrubs. In his letter dated 7th April 1902, Mr. Messer wrote, 'I send you specimens of a beetle which is particularly destructive in Katha this year though I have observed is for years past. It attacks fruit trees particularly, *viz.*, peach, plum, and mango (most of all), and it is not averse to certain ornamental shrubs in the gardens here. It eats the leaves, leaving only the mid rib and devours the flowering shoots wholesale, leaving only the bare stems. The damage seems to be done only by the imagoes, and I have seen nothing yet of larvæ or pupæ.'

In a letter dated 12th March 1903, written in reply to queries asking for information upon this latter point, Mr. Messer stated that the insect was just beginning to be numerous again upon the fruit trees in his garden.

It is thus apparent that the mature insect is to be found early in March, and the question to be answered is where does it lay its eggs, for it is probably egg-laying towards the end of March or early in April. Also where do the young larvæ live and how long is spent in this stage? Is there more than one generation in the year?

Remedies.—Until more is known about the insect the question of the best remedial measures to be employed must necessarily be held in abeyance. Spraying the trees with Paris-green poison solution would, if done carefully, kill off the beetles, but such could only be undertaken whilst the trees were still flowering or had only quite young fruit upon them. Once the fruit had reached or nearly reached a pluckable size (even if still green and unripe) spraying with poisons must be discontinued.

5. Longicorn Grubs.

Order, *Coleoptera.* Family, *Cerambycidæ.*

Some undeterminable longicorn grubs were sent by the Director, Land Records and Agriculture, United Provinces and Oudh, as injurious to young mango plants in the Deccan. They were said to bore into the branches. In the absence of adult beetles no identification of the pest can be made.

Remedies.—When young plants are badly affected by internal boring insects of this nature, the best plan, if the plants are at a

numerous, is to cut out and burn all infected ones as soon as noticed in order to prevent the attack from spreading.

Points in the life-history requiring further observation.

1. Length of time spent in the grub stage.
2. Length of time spent in the pupal stage.
3. When does the beetle emerge. Specimens of it should be sent to the Indian Museum, Calcutta, for identification.
4. How many generations of the insect are there in the year?

6. *Hymenopterous Gall on leaves.*

Specimens of a hymenopterous gall were sent to the Museum by the Superintendent of the Darbhanga Gardens on the 20th January 1903. They proved, however, too dry to enable the insects to be identified. The eggs are laid upon the leaves and the irritation set up by the young larva as soon as it hatches out boring into the leaf tissue causes a gall to form upon the leaves.

More fresh material is required in order that this pest may be studied and identified.

Insects infesting the PEACH (*Prunus persica*).

1. APHIS SP.

Order, *Hemiptera.* Family, *Aphidæ.*

Wingless larva.—Pale canary yellow of the usual aphid shape, the posterior segments being larger and thicker than the anterior ones; two siphons dorsally and posteriorly placed. Antennæ 7-jointed.

Winged adult.—Head black. Antennæ 7-jointed, blackish. Prothorax yellow dorsally with black transverse bands, ventrally a yellow band just beneath head, rest being black. Abdomen yellow with black patches dorsally; canary yellow on ventral surface. Siphons black. Scattered hairs on dorsal posterior segments of body (behind the siphons). Legs yellow, the femora (thighs) being black except just at their upper ends: lower portion of tibiæ black. Wings 4, colourless. Long. 1·3 to 1·8 millim.

This insect is a serious pest to Peach trees. The aphids cluster round the tops of the new year's shoots and on the leaves of young trees and suck out the sap, completely aborting the shoot. Young attacked trees have the ends of all the branches curled up, the new shoots becoming dwarfed, withered and brown. A closer inspection shows that the branches attacked have ceased growth, and instead

of long shoots two feet and more in length, a mass of short stunted growths a few inches only in length and rapidly dying is all that is visible. The new spring foliage that may have developed previous to the attack, or before it had become really severe, had all curled up and was turning brown or was already brown and dead.

In the attack in question inside the folds on all the green parts were numbers of the aphids in all stages from tiny little larvæ to winged insects.

In one instance a young tree had had all its foliage treated in this way and was evidently dying under the attack.

Remedy.—Spraying with kerosene emulsion was recommended in the attack in question.

The insect was found by the writer on some peach trees in the Eastern Dun in North India. All stages of the pest were taken between the 12th and 15th May 1902, and the pest was observed to be multiplying at a rapid rate. It was found that four predaceous coccinellid beetles were preying upon it. These beetles were *Hippodamia variegata*, var. *doubledayi*, *Cœlophora sauzeti*, *Chilomenes sex-maculata* and *Brumus suturalis*. These beetles are described on pp. 47, 51, 53, and 56 of this number.

Insects infesting JACK FRUIT TREES.

LONGICORN GRUBS.

Order, *Coleoptera*. Family, *Cerambycidæ*.

In January 1902 the Superintendent of the Gardens, Rajnagar, Darbhanga, forwarded some longicorn grubs which he stated bored into the trunks of Jack fruit trees causing the trees to bleed profusely. The identification of the insect could not of course be made from the grubs. The Superintendent stated that his practice was to syringe into the trees hot water or carbolic soap which he found effective.

Insects infesting the APPLE and PEAR in Kulu.

The fruit crop of Apple and Pear Trees in orchards in Kulu suffers very severely from insect attacks, but at present the originator of the mischief appears to be undiscovered. From the following letter on the subject which appeared in *Indian Gardening and Planting* it will be seen that Colonel Rennick, the owner of the orchards, attributed the infestation to the numerous maggots which appear in the rottening fruit. The flies bred out from these maggots

have now been identified, and it is proved that they could not have been the *originators* of the mischief. In other words, some other insect probably starts the injury by laying an egg or eggs on the young fruit: the grub or grubs hatching out bore into the fruit and at the wound thus caused, which would leave a small decaying spot on the surface, the flies probably lay their eggs or deposit the maggots. This would seem to be the probable manner in which the flies got into the fruit. It is necessary therefore to institute a search at an earlier period in the year for the aggressor.

The following are extracts from Colonel Rennick's letters on the subject to *Indian Planting and Gardening*. They show that the matter is one of considerably serious import to fruit growers in the Himalayas:—

"I have lost heavily by my fruit crop gathered after the 1st September. Every pear had been tainted and 40 to 50 per cent. of certain kinds of apples.

"I do not know what to do. I have sunk over ₹50,000 in laying out these orchards and in importing the finest specimens of fruit from France, Holland, England, and Austro-Hungary. Now that half the orchards are in full bearing, these horrid flies destroy the latter crop, which is the more valuable, piecemeal. Last year I lost 50 per cent. of my pears. This year every pear and almost every other apple was bad. You may judge the extent of the loss when I tell you I have barely recovered the ₹1,800 I have paid for carriage after the 1st September.

"The rains were so heavy and the foliage and the grass were so numerous that we could discover no flies about, and the manager did not spray the trees as the bark equipment of Vilmorel is barely powerful enough to spray the Kulu fruit trees, which attain, unlike those at home, a very large size. The sun came, and with the sun the fly which deposited its thousands of worms all round. I was away in Shigri prospecting, and my gardeners hardly knew what wholesale mischief the little insect was working.

"The fly in question is a brown fly marked with two streaks and spots on the back. It is the "dirt" fly—the brown one, and not the green or blue bottle. It deposits small living worms of this size (—) perhaps a little finer. After a while the little beast sinks into the fruit and destroys it. Last year I collected a whole lot of these maggots, put them into a large-mouthed bottle with 2 inches of earth and put in some of the rotten apples and pears. I was under the impression they were the maggots of the codlin moth, but at the end of 14 or 15 days here were as many flies as there were worms, somewhat yellow in

colour and not brown. I smothered them all, as I was convinced the intruder was the maggot of a fly which had been deposited on the fruit when it had come to maturity and not the one of the codlin moth, while the fruit was only a blossom.

"I am most grateful to you for your offer of identifying the fly. It was not known to the late Miss Ormerod. I am sending you by to-day's post a tin box of apples full of maggots and another small box full of male and female flies.

"I have killed two or three different kinds, but the one which does the mischief is the brown two-winged fly.

"The question now is, how is he to be destroyed and not driven away?"

On the 11th October, Colonel Rennick wrote:—

"I have sent you yesterday a small box containing two apples, which had been tainted by the fly. One, a Cellini, the other a Blenheim orange, a sweet and an acid one, which made no difference to the fly. You will find at the least a dozen fat maggots in them by the time the box reaches Calcutta. The maggots jump almost a foot when full grown. They are brought to life as small maggots and not as eggs,—so different from the home flies.

"In another box you will find two match boxes. One contains a lot of flies, both male and female, I have caught and killed with Cyanide of Potassium, and the other a lot of cocoons formed by the maggots on leaving the fruit to pupate in the soil.

"From last year's observations I found that the maggots, the stout and jumpy ones at any rate, took 13 to 14 days to come out as a fly. So I had all the fruit cut up and broken, thrown into long shallow trenches on the 26th September. On the 9th and 10th October, when I moved the rotten fruit, I found most of the maggots had left the fruit and gone into the soil and I had no difficulty in getting out lots of these cocoons for experimental purposes. The remainder I hope to have destroyed by flooding the trenches with a solution of sulphate of copper, soft soap and kerosene oil made up into a kind of concentrated emulsion. I find this mixture kills the maggots. I have hatched a lot of the young flies which I hope to send you in a day or two. I have built a breeding room about a cubic yard for propagating these flies and to ascertain their habits and their natural age. It is fitted with wire gauze ventilators and three large pane glasses to observe what goes on daily, hourly in the chamber. I have caught a fly to-day with a lot of live maggots in it, and I despair of eradicating the pest. I do not want to drive it away; but to entirely destroy it. Three flies I killed a short month ago, the first contained 82 live maggots, the second 64, and the third 67 maggots!! They are loathsome."

Mr. D. W. Coquillett kindly identified the flies submitted to him by Mr. Howard, and the latter writes as follows upon the subject :—

"The three flies which Mr. de Nicéville sent and which were considered to have done the great damage to the apple and pear crop are simply *Musca corvina* Fabr., *Sarcophaga princeps*, Wied., and *Sarcophaga tænionota*, Wied. The first of these three insects is cosmopolitan ; the second is from India and China, and the third from Java; that is, speaking from previous records. It is absolutely impossible that these flies should have done the damage to the apple crop described by Mr. de Nicéville. They will attack badly decayed fruit, and being probably bred from masses of rotten apples or captured upon such decaying stuff, they have erroneously been considered to have been the authors of the damage."

This is the present position of affairs. I repeat the first and most important point now to be discovered is what leads to the first decay in the fruit which enables the flies to lay the maggots in it. It is of the utmost importance that this should be observed and this entails a very careful watch being kept on the orchards whilst the trees are in the flowering and fruiting stage. Any insects found to be at all plentiful in the orchards at these periods should be collected and forwarded for identification.

Insect infesting GRAPE VINES.

Chærocampa butus.

Order, *Lepidoptera*. Sub-order *Heterocera*. Family, *Sphingidæ*.

Moth.—This moth is of an almost uniform olive green colour. There is a central dark line down the forewings. There is also a very distinct white line on each side of the thorax (above the base of the wings). The hindwings suffused with black with a yellow patch on inner and lower edge. The undersurface of the abdomen and wings yellowish, speckled with brown.

Larva.—The colour of the larva is usually a dirty brown. There is a light band on each side of the body.

The caterpillar feeds upon the leaves, injuring the plants and rendering them unsightly.

Remedies.—Since the larva is a large one hand-picking to remove them could be easily resorted to. All caterpillars collected should oe killed.

Spraying with Paris green or London purple (see previous volumes of these Notes) could be resorted to as long as there are only flowers or young and immature fruit upon these trees. This spraying would have the advantage of also killing off other leaf-feeding insects upon the plants.

II.—Insect Pests of Plants.

Insect infesting Hedges in Rurki.

1. *Clania crameri,* Moore. The Faggot Worm.

Order, *Lepidoptera.* Sub-order, *Heterocera.* Family, *Psychidæ.*

Previous Reference.—I. M. Notes, Vol. I, p. 204, Vol. II, p. 157,; Vol. III, p. 133 and 14 (4); Vol. IV, pp. 17 and 41.

This insect, as will be seen from the above references, has often been alluded to in these notes.

In this instance it appeared in numbers on the hedges in the Royal Artillery Lines at Rurki and was sent for identification to the Superintendent of the Saharanpur Botanical Gardens, who forwarded the specimens to the Museum.

Remedies advised.—(*a*) Collection of larval cases by hand-picking. As the female moth is wingless and never leaves the case, the eggs being laid in it in the later stages of the attack (*i.e.*, when the little faggots are seen to have become stationary), this is the best remedy. Burn all collected cases.

(*b*) Spray the hedges with a solution of Paris-green or London Purple. The method of doing this has been often previously described in these notes.

Insect infesting Ornamental Shrubs.

2. *Hypomeces* sp.

This insect has already been described above under the mango. It defoliates ornamental shrubs and plants in Katha in Burma.

3. *Tinea ?* sp. larva.

The Secretary of the Agri.-Horticultural Society of India, Calcutta, sent some 'flies' attacking rose bushes. In a rose twig a small caterpillar, probably a species of *Tinea,* was discovered, but it died and nothing further has as yet been made of this attack.

Insects attacking Castor Oil plants.

The following insects were identified for the Government Botanist, Madras:—

Parasa lepida, Cram., alluded to in these notes, Vol. II, p. 158; Vol. III, p. 12 (4); Vol. IV, pp. 21 and 42.

Euproctis fraterna, Moore.

The caterpillars were reported as defoliating castor oil plants.

III.—Insect Pests of Vegetables.

Insect infesting Cucumber and Pumpkins.

1. *Aspongopus janus,* Fabr.

Order, *Hemiptera.* Family, *Pentatomidæ.*

(Plate IV, fig. 3, 3*a*.)

This insect is one of the true bugs. The head is a deep black, the portion behind being red and black. The triangular-shaped portion at junction of upper wings (the scutellum) is black anteriorly, being rufous only at apex. Upper wings red; lower ones black: body black with an elevated margin which is red. Feet are black. Length ¾ inch. Plate IV, fig. 3, 3*a* show a dorsal and side view of this bug.

This insect was sent in August 1902 from Chanda in the Central Provinces. It was reported by Mr. A. E. Lowrie, Deputy Conservator of Forests, to have appeared in his garden in swarms and to have attacked cucumber and pumpkin stems, committing a great deal of damage.

The insect commits the damage by sucking out the sap from the plants it attacks.

Remedy.—Spraying with kerosene emulsion should kill off the insects, or cause them to leave the plants. Hand-picking should be resorted to in vegetable gardens, as the larger the number of insects destroyed the smaller will be the number of eggs deposited on the area, and consequently the fewer the number of insects appearing at the next generation.

Points in the life-history requiring further observation.

1. Period the insect takes to arrive at maturity (*i.e.*, develop its functional wings) from the date of egg-hatching.
2. Period spent in feeding and egg-laying by adult insect.
3. When the eggs are laid.
4. Number of generations in the year passed through by the bug.
5. The different food plants of the insect.

Insect infesting Cornflour plants (*Centaurea*).

2. *Dorylus orientalis,* Westw.

Order, *Hymnoptera.* Family, *Formicidæ.*

(Plate IV, figs. 4, 4*a*.)

I. M. N.—*Previous references*—IV, 4, 198; V, 39, 42, 44, 65, 77-79.

This curious ant which, alone in its own sub-family, seems to attack plants has often previously been reported in this connection.

In this instance the insect was sent from the Botanical Gardens, Calcutta, by Major Prain, I.M.S., who stated it was attacking the roots of cornflour plants. The ants are shown in Plate IV, figs. 4, 4*a*.

Mr. Forel to whom the ants were sent for identification, writes: The ant ... is *Dorylus orientalis*. It is nearly incredible that this species should be alone in the sub-families *Dorylinæ* and *Ponerinæ* in thus attacking vegetables. All other *Dorylinæ* are carnivorous and hunting ants.

Remedies proposed.—Spraying with the Paris green solution would prove effective, but it could not be used on vegetables which were to be shortly after made use of for food.

Points in the life-history requiring further observation.

There are a good many points of interest in connection with this ant which require observation. We require to know what sites the ant chooses for its nest, which it prefers and at what times in the year it makes its appearance to commit damage.

Insects infesting POTATO plants.

3. *Pyralid caterpillars.*

Order, *Lepidoptera.* Family, *Pyralidæ.*

The Sub-Divisional Officer of Narail reported that potato plants were suffering in his sub-division from a worm which cut the stems. In January and February considerable destruction took place from this cause. The insects sent were caterpillars, probably *Pyralidæ*, which apparently mine up the stems internally and kill the plants. Without the adult moths no determination could be effected.

Remedy suggested.—Dig up and burn all plants seen to be attacked by the worms or, if practicable, cut off infected parts.

Points in the life-history requiring further observation.

1. How long do these worms spend in the potato stem?
2. Where do they change into the pupal state? Is it within the stem? or do they leave the stem and go down into the soil?
3. When do the moths emerge and where do they lay their eggs? Is it on the potato plant?
4. How many generations of the insect are there in the year?
5. What other plants does the caterpillar live upon or in?

IV.—Insects Affecting Cereals and Crops.

Insect infesting Kutki (*Panicum milare*).

1. *Cantharis rouxi*, Cast.

Order, *Coleoptera.* Family, *Cantharidæ.*

(Plate IV, figs. 5, 5*a*).

Vernacular name 'Ghauri' in Central Provinces.

A slender soft beetle. Head is bright sienna brown in colour, the eyes being black. Legs more or less ochreous. Wings of a uniform ochre colour. Length $\frac{7}{8}$ths inch. See Plate IV, figs. 5, 5*a*.

This beetle has been reported as attacking and eating the green ears of the *kutki* crop in the Seoni district in the Central Provinces. The insect is said to thrive during a break in the rains, but is killed off by heavy rain. As the crop ripens the beetle appears to be unable to attack the hardening grain. The same insect was reported about the same time—beginning of September 1902—from Saugor in the Central Provinces, by Major W. D. Sutherland, M.B., I.M.S. He stated it had appeared first on 24th August, and on the 3rd September was still present in the place. It had caused a considerable amount of discomfort both to Europeans and Natives in the town owing to its blistering proclivities.

Remedial measures.—In the fields spraying with a poison, such as Paris green, should prove an effective remedy when it is possible to apply it.

When pests of this nature appear plentifully in a town, gangs should be organised and employed to collect or sweep them up. Creosote oil (the 'l'huille lourde' of the trade) may be used to sprinkle over the heaps, thus preventing the disgusting effluvia which will be given off from the rotting heaps of dead bodies.

Points in the life-history requiring further observation.

1. When and where the eggs are laid and where the larvæ feed.
2. Length of time spent in these stages of its life.
3. The number of generations in the year.

Insects infesting Minor Millets.

2. *Cantharis tenuicollis*, Pallas.

Order, *Coleoptera.* Family, *Cantharidæ.*

(Plate IV. figs. 6, 6*a*.)

This insect is not unlike the above described beetle. It is slender in build. Head and wings bright metallic green; thorax and eyes

brown. In the legs the femora (thighs) are metallic green, the tibiæ (shanks) and tarsi being brown. Length $\frac{3}{4}$ inch.

Plate IV, figs. 6 and 6a, shows this beetle in two positions.

This beetle was reported in the middle of September from the Central Provinces as causing damage to the minor millet crops. This is all that appears to be known about the pest.

In addition to the remedial measures described above under *C. rouxi* it was recommended that when numerous the insects should be driven through the fields against tarred screens or mats. Any other suitable sticky substance may be used instead of tar.

Insect infesting MAIZE (*Zea Mais*).

3. Curculio sp.

Order, *Coleoptera*. Family, *Curculionidæ*.

(Plate IV. figs. 7, 7*a*).

Beetle.—Elongate, fairly slender with short angled antennæ. Prothorax with a transverse depression about centre. Pitted. Elytra slope to a blunt point behind. Are pitted and convex. Plate IV, figs. 7, 7*a*, shows this insect.

This weevil was reported as committing serious destruction amongst maize seedlings in the Panch Mahals District, Bombay Presidency.

In the absence of any further information as to method of attack upon the seedlings and notes upon the life-history of the pest, which was new to the Indian Museum Collections, it has not been possible to prescribe any remedies.

With the exception of the fact that the insect is in its adult stage at the beginning of August, nothing is known about the life-history of the pest.

Insect infesting WHEAT.

4. Myllocerus (?) sp.

Order, *Coleoptera*. Family, *Curculionidæ*.

(Plate IV, figs. 8, 8*a*).

A small weevil. Body markedly convex. Elytra brown slightly mottled with greyish white. Antennæ and legs brown. Length $\frac{1}{4}$ inch. See Plate IV, fig. 8, 8*a*.

This weevil was sent to the Museum by the Director, Land Records and Agriculture, United Provinces and Oudh, as committing great damage to young wheat plants on unirrigated plots of land. The beetles feed upon the wheat leaves by stripping off the epidermis and also by eating out holes in the leaf tissue. When

frightened the insects are said to drop off the leaves and to hide in the furrows between the rows of plants. The beetles were said not to have been found on irrigated land. They were reported from the Cawnpur Farm towards the end of December 1902, when they appeared in great numbers on almost every plant in the early stages of growth. The insect is new to Indian Museum Collections. Nothing further appears to be known about its life-history.

Points in the life-history requiring further observation.

1. Where are the eggs laid ?
2. Where do the grubs feed ?
3. How often do the beetles appear in a year, *i.e.*, how many generations are passed through ?

Insect infesting GANJA.

5. *Plusia nigrisigna,* Walk.

Order, *Lepidoptera.* Sub-Order, *Heterocera.* Family, *Noctuidæ.*

(Plate IV, fig. 9)

I. M. N. Previous Refer. II, 6, 161.

Moth.—Forewings irridescent golden brown, the uniform colour being broken up by wavy light bands across the wings. Two small silvery specks in centre of each of the forewings. Hindwings light brown. Fig. 9 shows this moth.

Caterpillar green with whitish dorsal and lateral lines.

The caterpillars were reported as feeding upon ganja plants in January. Some of the grubs taken by the Sub-divisional Officer, Naogaon, were sent to the Museum and moths of the above species were reared from them.

Insect infesting JUAR (*Andropogon vulgare*).

6. *Chilo simplex,* Butl. The Sugar-cane Borer.

Order, *Lepidoptera.* Sub-Order, *Heterocera.* Family, *Pyralidæ.*

Previous references in these Notes.—Vol. V., 21, 41, 65, 169.

This insect was very fully described in the above quoted number of these notes.

Juar stalks were found bored by a caterpillar in the rains in the Central Provinces. The grub was said to do considerable damage to young plants in seasons of light rainfall, but seems to be killed off by heavy rain. The grub hollows out the interior of the stem and

then changes to a chrysalis inside it. Moths were reared out of infected stems sent to the Museum and proved to be *Chilo simplex*, the well-known sugar-borer. We thus have another authentic case of this insect attacking juar, and it is evident that cane fields situated in the neighbourhood of juar fields may become infested by the borer from the latter, and *vice versâ*.

Cane should not be rotated with juar without allowing the ground to lie fallow for at least one season.

Insect infesting *Kalai*.

7. *Spilosoma punctatum*, Moore.

Order, *Lepidoptera*. Sub-Order, *Heterocera*. Family, *Arctiidæ*,

(Plate IV. fig. 10.)

Moth.—Forewings ochreous yellow speckled with a few black dots which form a more or less irregular line some distance from the outer margin. These spots are sometimes almost obsolete. Hind-wings yellowish, sometimes with a tinge of orange. A black speck in centre of and near the upper margin and a similar speck near the lower margin. Body red with a series of black dots, one dorsal and two lateral. Thorax ochreous yellow. Legs—thighs red, tibiæ and tarsi brown. Pl. IV, fig. 10 shows this moth.

Caterpillar hairy.

The caterpillars were reported by Mr. H. E. Parrett, C.S., Collector of Dinajpur, as seriously injuring Kalai crops in the Kaliagani Thana of that district in October 1902. Moths were reared in the Museum from caterpillars sent in October 1902.

Insect infesting *Til* and *Oorid*.

Undetermined caterpillars locally known as "Bhuili." These were reported by Mr. M. C. McAlpin, C.S., Sub-divisional Officer of Bettiah, as causing damage to the young plants in fields of *til* and *oorid*. No moths were sent and it has therefore been impossible at present to identify the insect.

8. *Hieroglyphus furcifer*, Sauss.

Order, *Orthoptera*. Family, *Acridiidæ*.

Previous references in these notes.—I. 203; II. 30, 171; IV. 29, 43, 190; V. 20, 49.

Specimens of this insect were sent from the Government Museum, Madras. They were reported to have done some damage to 'crops'

in a village in the Pattukottai Taluk of the Tanjore District. The insects were said to have been almost destroyed by the villagers.

V.—Insects Affecting Sugarcane.

1. Chilo simplex, Butler. The Sugarcane-borer.

Order, *Lepidoptera.* Sub-order, *Heterocera.* Family, *Crambidæ.*

The caterpillar of this moth was again reported as infesting sugarcane in August-September in the Nagpur districts. Specimens were received from the Commissioner of Settle ments and Agriculture.

In June of the same year (1902) the Sub-Divisional Officer, Jangipur, reported caterpillars, thought to be this species, to be infesting an experimental crop of sugarcane seedlings. The insects were also present in neighbouring fields of cane, and the damage done was very large.

A similar report was received from the Collector of Gaya, the insects having appeared in the Aurangabad Thana in June.

Remedies.—There can be little doubt that until proper steps are taken to carefully inspect all seed cane, all infested material being at once burnt, there is little chance of gaining control over this pest. Cleanliness in methods of cultivation, collection, and burning of litter and refuse in the fields are also requisites. A rotation with a crop such as juar should be avoided as the insect lives equally well in both.

VI.—Insects Affecting Cotton.

1. Oxycarenses lugubris, Motsch.

Order, *Hemiptera.* Family, *Lygaeidæ.*

A small bug, $\frac{3}{16}$ths inch in length. Head and thorax brown. The wings are semi-transparent, and overlap the abdomen on all sides. The antennæ are long, upper end black, lower end brown. The prothorax and head are in the form of a triangle, the head forming the apex.

This insect feeds amongst the cotton fibre inside the capsules of the plant. It was reported from Cawnpore Farm at the beginning of May by the Director of Land Records and Agriculture.

2. *Dysdercus cingulatus*, Fabr.

Order, *Hemiptera.* Family, *Lygaeidæ.*

Previous references.—I. M. Notes, Vol. I., pp. 111, 127, 212; Vol. II, pp. 33, 44, 136; Vol. III, p. 57 (5); Vol. IV, pp. 37, 43.
(See Agric. Econ. Entom. Circ. No. 8.)

This insect was reported to feed upon the leaves of the cotton plant in May 1902. It was sent in company with the above described bug.

The insect has been previously reported as feeding upon cotton at the Kirkee Government Farm near Poona, in the Punjab and at Seringapatam. The bug is to be found all over the continent and has at least three generations in the year, one appearing in March-May, a second in August and a third in November-December.

Remedies.—If practicable, spray the plants with kerosene emulsion.

The Assistant Entomologist, Mr. Peal, has found that *D. cingulatus* was attacked in Calcutta by a fungus, but nothing further seems to have been noted upon this subject.

Points in the life-history requiring further observation.

(1) The time spent in the young stages until the insects have acquired fully functional wings.
(2) Time spent in the adult stage.
(3) Number of generations in the year.

3. *Sylepta multilinealis*, Green.

Order, *Lepidoptera.* Sub-order, *Heterocera.* Family, *Pyralidæ.*

A small moth. Colour light yellow. Head and thorax spotted with brown. All fore wings are covered with a close network of brown lines. There is a brown edging to the outer margin of all fore wings.

The pupa from which a moth was bred out was found upon a cotton plant leaf in a cotton field on the Cawnpore Farm towards the end of August. The moth was identified in the Museum.

4. *Hymenia recurvalis*, Fabr. Syn. for *Zinckenia fascialis*, Craw.

Order, *Lepidoptera.* Sub-order, *Heterocera.* Family, *Pyralidæ.*

A small moth. Body and wings dark brown. The forewings have two white streaks, one on the costa some distance from the apex

running almost to centre of wing, and one running from centre of lower margin to beyond the centre of the wing. This latter streak is more or less triangular in shape. The hind wings have a broad central white streak almost connecting costa to lower margin. Legs white speckled with black.

This insect was sent from the Cawnpore Farm where it was caught on the wing in the cotton fields at the beginning of September 1902. It is not as yet known whether its larva feeds upon the cotton plant.

In the case of both of the above insects we require to know where the caterpillar lives, upon what it feeds, and how long it spends in this stage. How long is spent in the chrysalis stage. How long is spent in the adult or moth stage; where the eggs are laid and how many generations the insect passes through in the year.

VII.—Insects Affecting Tea.

Thosea cana.

Order, *Lepidoptera.* Sub-Order, *Heterocera.* Family, *Limacodidæ.*

Previous reference.—I. M. Notes, Vol. V. No. 3, p. 136 (larva and pupa).

Moth.—Colour greyish brown. Forewings with a dark oblique line with light outer edge near centre of wing. Hind wing slightly browner.

Larva.—Green; a yellowish white stripe down back and rows of tubercles on it.

The caterpillars of this insect made their appearance on the Udaleah Tea Estate in the Chittagong district in the middle of November 1902 and committed considerable havoc by defoliating the tea bushes. Specimens of the moth were reared by Mr. Mann in Calcutta and the insect was identified from them.

These caterpillars have previously been reported as appearing in the months of January.

Mr. Burnell, the Manager of the Udaleah Tea Estate, wrote as follows with reference to the attack at present under notice:—"I am sending you by dâk bangi a small bottle containing specimens of a hairy caterpillar which has made its appearance at Kolapania, and is doing havoc amongst the tea plants. I have never known its prevalence in other years, and it has appeared in large numbers, and no less than 50,000 have been collected during the last three days and destroyed by fire. I should like these caterpillars sent to the Indian Museum and have a report thereon, for I believe they are found on Assam and Duars Gardens. ..... These caterpillars have also lately

made their appearance at a neighbouring Garden, Baramasia, Fatichira Tea Company."

Remedies.—Collect and burn the caterpillars and chrysalids. Mr. Burnell, by taking the prompt action he did in the matter, undoubtedly saved his tea bushes from a later and what would have almost certainly proved an even more serious attack. In the case of sudden visitations of this nature upon tea bushes there can be little doubt that a few dozen smart youngsters put on to the infested area with baskets, or better still kerosene tins containing a little dilute kerosene, to collect the caterpillars at work, and chrysalids if the insect is pupating upon the leaves, is the quickest way of ridding the attacked bushes and has the additional advantage that the danger of future attacks is quickly reduced to a minimum by the insect thus being prevented from reaching its egg-laying stage.

Points in the life-history requiring further observation.

1. When the eggs are laid.
2. Length of time passed in the larval state.
3. Number of generations in the year.

VIII.—Insects Affecting Fabrics.

Anthrenus vorax, Waterh.

Order, *Coleoptera.* Family, *Dermestidæ.*

Beetle.—Small, yellowish, spotted with brownish black. Length $\frac{3}{16}$th inch.

Grub.—Light brown in colour, covered with a quantity of long brown hairs.

This insect is reported from Cawnpore, where it is a source of considerable loss and trouble to the Cawnpore Woollen Mills Company, Limited. The Manager in sending the insect to the Museum forwarded the following notes upon its life-history:—

"The winged insects (beetles) which we sample lay their eggs in wool and woollen goods, and the resulting hairy grub, also included in the specimens, is most destructive, as it appears to thrive and fatten on wool and wool alone. It is chiefly at this season" [the manager's letter is dated 23rd April 1902,—*Ed.*] that the grub loses its larval character and is transformed into the beetle now submitted, and there are countless myriads of them in our godowns and wool sheds. The grub is most in evidence in the rains and cold weather. The worm-like insect we are not so clear about but we believe it to be a wool eater."

From the above excellent observations it is apparent that this beetle has at least two generations in the year, the grubs of the first

being found in April, those of the second in the rains, *i.e.*, July or August probably. The Manager stated, however, in a subsequent letter that larvæ were to be found to a certain extent all the year round.

The following further interesting note upon the subject was forwarded to us by the Manager :—

"We have been troubled with this insect pest for the past 25 years; the damage has been progressive in the sense that we have now a very much larger stock of wool than we formerly had and the insects have consequently more extensive growths. Fumigation, I regret, would be impracticable, as all our wool sheds are open to the atmosphere—some on all four sides, others on three sides. The damage done by these insects is considerable, in that it amounts in value to several thousands of rupees yearly, and you will therefore appreciate our desire to find a practicable remedy. It seems to us that the only chance we have of holding the pest in check is by the liberal use of some insecticide which, whilst not injuring the wool in any way shall prove noxious to the insects. Could you put us in the way of obtaining such an article? It would have to be used literally by the ton before we could hope to make any headway."

The Assistant Entomologist of the Museum, Mr. Peal, visited the Mills and the following short report on the subject is from his pen :—

"I paid a visit to the Cawnpore Woollen Mills during the 3rd week of June 1902. I first examined the wool sheds which are large, more or less open structures placed not far away from the mill proper.

"The wool was stacked in piles along the sides and in the centre of the sheds. Wool from all parts of India and from Australia is stacked here; the wool being in most cases, I think, in tightly pressed bales, but there was also a quantity which appeared to be merely baled and not pressed. I was informed that it was believed that the pest was first introduced in wool coming from Rajputana. On examining the bales I found them in very many cases badly attacked by the pest. Living grubs and beetles were present in very large numbers. The wool in many cases was reduced almost to rubbish and even where the harm done was less, it appeared to be much damaged and presumably its value depreciated by the staple being shortened and cut up into small lengths.

"I was informed that it was the practice to have all damaged wool handpicked, the percentage of serviceable wool recovered being variable, but in many cases 15, 20, or even 30 per cent. of the wool was utterly ruined.

"I found the insect in the grub pupal and adult stages in large numbers. The beetles were flying about to some extent. I noticed

that coolies were employed in the alley ways between the piled up bales, in sweeping up the *debris* from the bales, this *debris* consisting chiefly of commuted wool and living grubs and pupæ, empty pupal cases and dead beetles.

"I was informed that the pest not only attacked the wool in the sheds, but also woollen articles of clothing, etc., in the houses of the employees. These houses were situated just across the road and within a few yards from the back of the wool sheds. The beetles flying about in the houses in large numbers in themselves constituted a pest.

"It is to be feared that the pest has obtained too great a hold on the wool sheds to be eradicated by any ordinary means. Judging from the way the bales are packed and stored, and owing to the open nature of the wool sheds, I am afraid that the only remedy that could be used would be by the use of carbon bisulphide gas.

I suggested the use of a large chest, sufficiently large to contain several bales, in which the wool could be fumigated, this work being carried on as rapidly as possible. That the work should be undertaken in the cold weather for two reasons: First, owing to the inflammability of C S 2, and also because the beetle being then least in evidence there would be a smaller chance of reinfection during the time that fumigation was undertaken. I also recommended lime washing the sheds."

A Ceylon Pest.

Caprinia conchylalis, Green.

Order, *Lepidoptera Heterocera.* Family, *Pyralidæ.*

(Plate IV. figs. 11, 11*a*, 11*b*.)

Moth.—Pure white; head black-brown, the palpi with a metallic tinge. Anal tuft of male black. Forewing has a broad brown band along its upper margin. Margins of all wings silvery-white. Expanse of wings $1\frac{3}{5}$ to $1\frac{4}{5}$ inches.

This insect is common in India.

Plate IV. figs. 11, 11*a*, 11*b* show the moth, larva, and pupa, of this pest.

Specimens of this insect were received from Mr. Green from Ceylon with the following note:—

The larva of this moth attacks the young foliage of the Kickxia trees at the time they put out new leaves (twice a year) and seriously checks the growth. On our plants every single branchlet is occupied by one or more of the caterpillars. Like most Pyralidæ they spin together the leaves and feed under that shelter—a habit

which makes it difficult or impossible to reach them with any spraying operations. The only practical treatment at present is to watch for the earlier indications of attack, and pluck off all affected leaves.

Economic Entomology in Ceylon.

Of recent years Economic Entomology, under the able guidance of that indefatigable and distinguished Entomologist, Mr. E. Ernest Green (who holds the appointment of Government Entomologist) has made great strides in Ceylon. We have recently received two excellent circulars from his pen which we would wish to shortly draw attention to here.

The first* deals with the life-history of the Tea Tortrix (*Caprea coffearia*, Nietner) an insect which was described in Ceylon as long ago as 1861 by Nietner, it having proved an enemy to the coffee plant in the island. Of recent years the insect has come again into prominence, its food plant now, in the absence of the coffee, being the tea bush. The outbreaks were at first spasmodic, but during the last three years they have become of a more permanent character and the insect is responsible for a considerable annual loss of yield in some localities, this being estimated on some estates at Rs. 10 per acre.

Mr. Green tells us that the yellow eggs are laid upon the tea leaves. They are very visible and it is this stage that is recommended as the best in which to institute preventive measures. The larva is dull green in colour with a shining black head and spins two leaves together, living in the shelter and feeding on the enclosed surfaces of the leaves. About a week is spent in the pupa stage. The moths are pale reddish brown in colour, often striated and mottled with darker markings. Six to eight weeks is the period of one generation from egg to moth and there are several generations in the year.

Mr. Green deals at length with various measures of attacking the pest and mentions the known natural checks. The larva also feeds upon Grevilleas, Acacias, Albizzias and even Eucalyptus trees, besides many jungle plants.

The circular is well illustrated.

The second circular † describes the life history and gives notes upon a severe attack of the Lobster Caterpillar (*Stauropus alternus*) an insect which has been known for some time and which would attract attention if only owing to the remarkable shape of its caterpillar.

* Circulars and Agricultural Journal of the Royal Botanical Gardens, Ceylon, Volume II, No. 3. The Tea Tortrix by E. Ernest Green.

† Circulars and Agricultural Journal Royal British Botanical Gardens, Ceylon II, V (1903). The Lobster Caterpillar. A Tea Pest in Ceylon, by E. Ernest Green.

In a letter received from Mr. Green in April he wrote: "Did I tell you of the recent extraordinary outbreak of Lobster Caterpillar on tea here?" (Ceylon). "The caterpillars were present literally in millions. Over 24 acres (which they have stripped absolutely bare) they averaged 300 to the bush. Off one single bush I picked and counted 1,849 individuals."

Mr. Green notices that, although the caterpillar from its size, colour and remarkable form (see figure in Vol. III, No. 4, p. 11 of these Notes) would be thought to be a very conspicuous one, yet, as a matter of fact, it was usually difficult to see it on the bushes as, owing to its characteristic contorted attitude, it very closely resembles a piece of withered and crumpled leaf.

The caterpillars appeared in January-February. Moths began to appear at the end of February and in March were present in thousands laying their eggs upon the tea bushes.

The circular describes the life-history of the pest and suggests various remedial measures.

It is illustrated by three plates.

We would recommend tea planters in India to procure and read copies of these excellent circulars.

Helopeltis theiovora, Waterhouse

Plate I—

Fig. 1. Hemelytron (× 14) . . . . . .
„ 2. Hind Wing (× 14) . . . . . .
„ 3. Edge of membrane of hemelytron, highly magnified
„ 4. Do. do. do. do. do.
„ 5. & 6. Hind leg (× 15) . . . . . .
„ 7. Hind tarsus (× 60) . . . . . .
„ 8. Tip of Scutellar Horn (× 50) . . . .
„ 9. Scutellar Horn (× 20) . . . . . .

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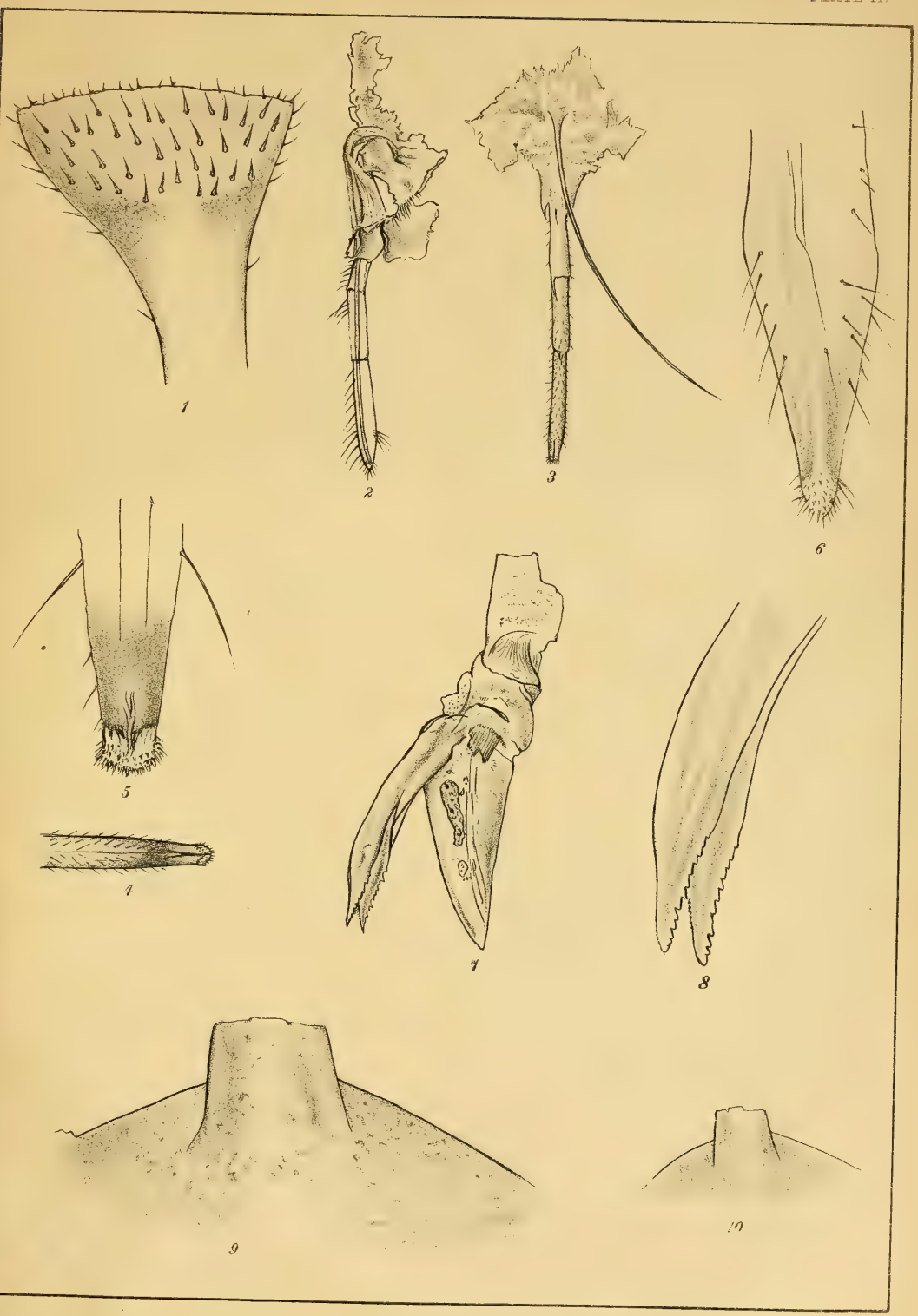
HEOPELTIS THEIVORA, WATERH.

Helopeltis theiovora, Waterhouse.

Plate II—

Fig. 1. Tip of Scutellar Horn (× 170)
„ 2. Rostrum, showing insertion of setæ (× 20)
„ 3. Do. with setæ extracted, showing one seta (× 20)
„ 4. Tip of Rostrum (× 60)
„ 5. Do. do. front view (× 140)
„ 6. Do. do. side view (× 140)
„ 7. Ovipositor, attached to abdomen (× 24)
„ 8. Tip of Ovipositor (× 60)
„ 9. Anal aperture of female (× 60)
„ 10. Do. do. do (× 25)



HELOPELTIS THEIVORA, WATERH.

PLATE III—

FIG. 1. *Hippodamia variegata* var. *Doubledayi*, Muls.—1, Pupa *in situ* on Peach leaves; 1*a*, male; 1*b*, female beetle .

„ 2. *Hippodamia constellata*, Crotch.—Beetle . . .

„ 3. *Coccinella septem-punctata*, Linn.—Beetle . . .

„ 4. *Cœlophora Sauzeti*, Muls.—4, larva; 4*a*, beetle . .

„ 5. *Synonycha grandis*, Muls.—Beetle . . . . .

„ 6. *Chilomenes sex-maculata*, Muls.—Beetle . . . .

„ 7. *Chilocorus circumdatus*, Muls.—Empty larval skins on a piece of bark . . . . . .

„ 8. *Brumus suturalis*, Muls.—Beetle . . . . .

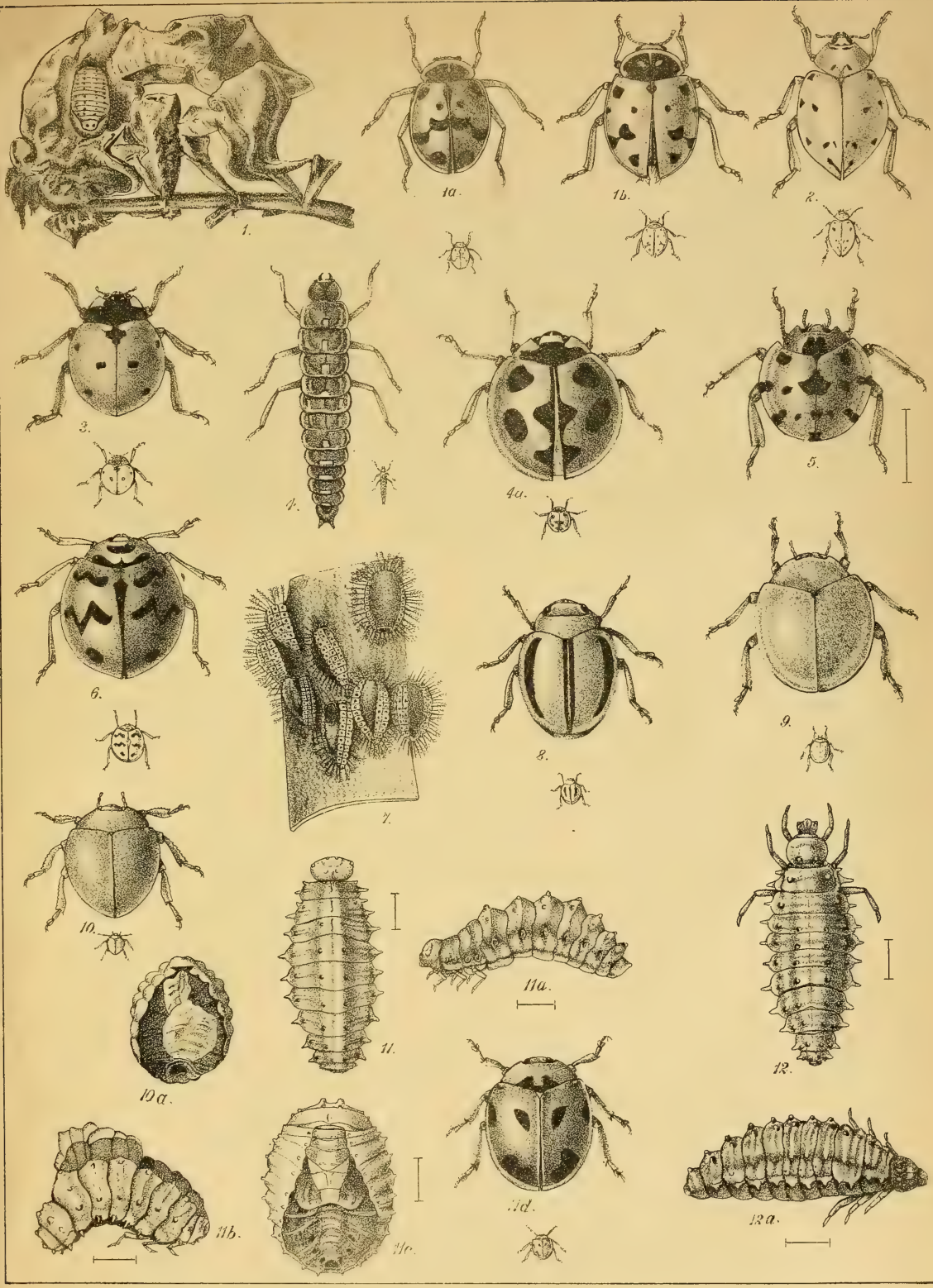
„ 9. *Vedalia fumida* var. *roseipennis*. Beetle . . .

„ 10. *Vedalia discolor*,—10, Pupa case; 10*a*, beetle . . .

„ 11. *Vedalia Guérinii*, Crotch.—11, 11*a*, dorsal and side view of larva; 11*b*, 11*c*, dorsal and side view of pupa; 11*d*, beetle . . . . . .

„ 12. *Vedalia* sp.—12, 12*a*, dorsal and side view of larva .

NOTE.—The small figures and hair lines represent the actual size of the insects.



G. C. Chuckraburtty, del. Litho. by A. C. Chowdhary.

1. Hippodamia variegata var. doubledayi, Muls.
2. Hippodamia constellata, Crotch.
3. Coccinella septem-punctata, Linn.
4. Coelophora sauzeti, Muls.
5. Sinonycha grandis, Muls.
6. Chilomenes sex-maculata, Muls.
7. Chilocorus circumdatus, Muls.
8. Brumus suturalis, Muls.
9. Vedalia fumida var. roseipennis.
10. Vedalia discolor.
11. Vedalia guérinii, Crotch.
12. Vedalia sp.

PLATE IV—

FIG. 1. *Dinoderus distinctus* Lesne—1, 1*a*, dorsal and side view of beetle; 1*b*, antennæ; 1*c*, leg (all magnified).

„ 2. *Hypothemnus*? sp.—2, 2*a*, dorsal and side view of beetle; 2*b* and 2*c*, antennæ and leg; 2*d*, larva (all magnified) . . . . . .

„ 3. *Aspongopus janus* Fabr.—3, dorsal view; 3*a*, side view .

„ 4. *Dorylus orientalis* Westwr.—4, dorsal view; 4*a*, side view

„ 5. *Cantharis rouxi* Cast—5, dorsal view; 5*a*, side view .

„ 6. *Do. tenuicollis* Pallas—6, dorsal view; 6*a*, side view . . . . . .

„ 7. *Curculio* sp.—7, dorsal view; 7*a*, side view . . .

„ 8. *Myllocerus*? sp.—8, dorsal view; 8*a*, side view . .

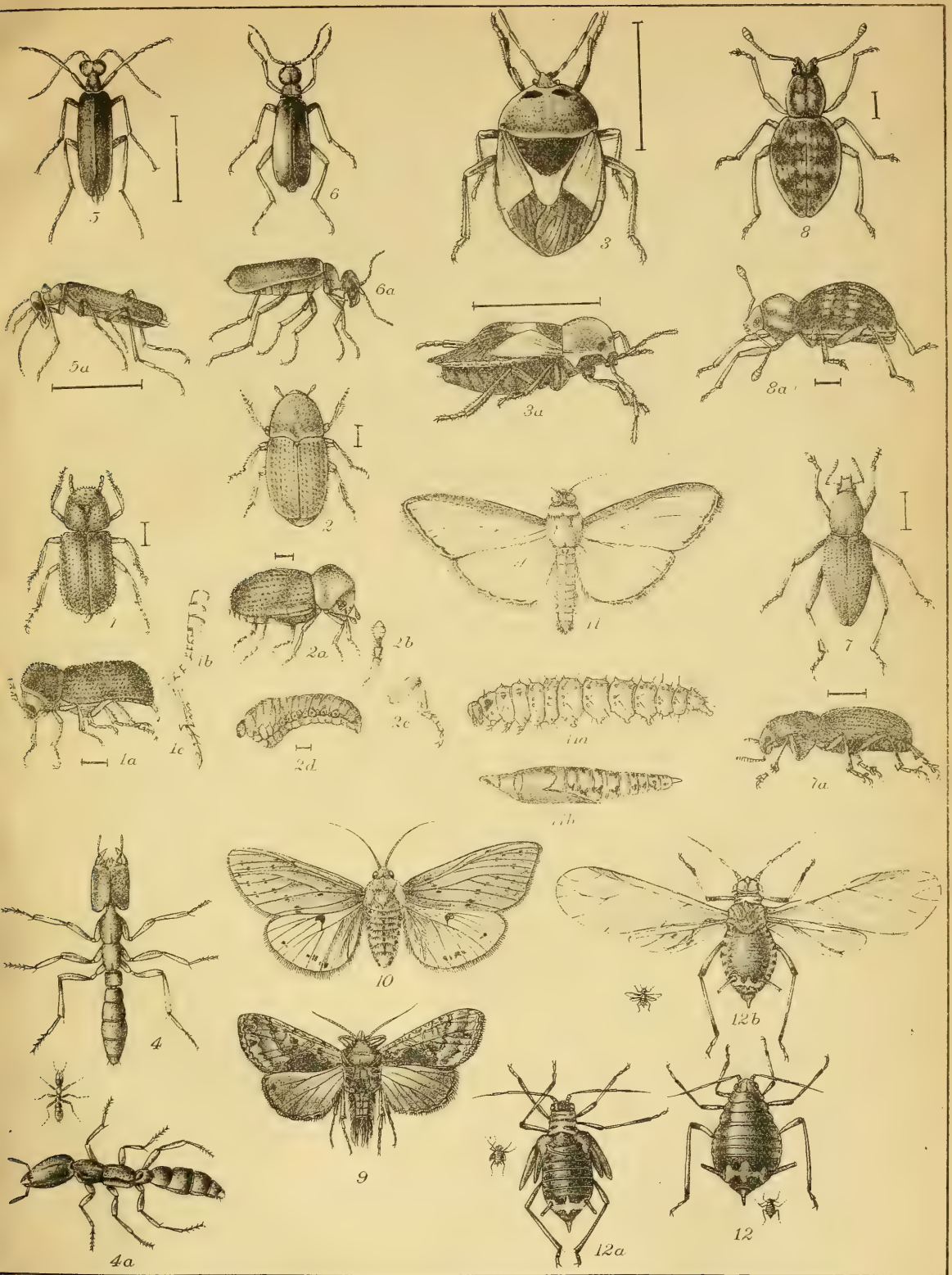
„ 9. *Plusia nigrisigna*, Wlk.—Moth . . . . .

„ 10. *Spilosoma punctatum* Moore.—Moth . . . .

11. *Caprinia conchylalis* Guen.—11, Moth; 11*a*, larva; 11*b*, pupa . . . . . .

12. Aphis sp.—12, 12*a*, young stages; 12*b*, mature winged insect . . . . . .

NOTE.—The small figures and hair lines give the actual size of the insect.



1. Dinoderus distinctus, Lesne.
2. Hypothemnus ? sp.
3. Aspongopus janus, Fabr.
4. Dorylus orientalis, Westw.
5. Cantharis rouxi.
6. Cantharis tenuicollis.
7. Curculio sp.
8. Myllocerus ? sp.
9. Plusia nigrisigna, Wlk.
10. Spilosoma punctatum, Moore.
11. Caprinia Conchylalis, Guen.
12. Aphis sp.

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