

INTRODUCTION.

By P. VAN DER GOOT.

The following pages contain a somewhat shortened account of a very thorough and interesting study on the Aphididae of Lahore by the late Mr. Das, which study originally was submitted as a thesis for his Doctorate in the Punjab University. Mr. Das' sudden death unfortunately prevented the publication in full of his valuable paper. Financial reasons making it impossible to publish the study as a whole in the "*Memoirs of the Indian Museum*," the writer was consulted by Dr. Annandale, now Director of the Zoological Survey of India, as to the possibility of publishing those parts of Mr. Das' paper that might contain any information either new or interesting to science.

After having looked through the manuscript of the late Mr. Das' paper, it was thought advisable to omit from the original paper all descriptions of recorded species that had already been sufficiently dealt with by other authors. Of the different well-known species all particulars available as to their biology in India have however been retained in full. The descriptions of different new species are published here in the original form as Mr. Das has put them down, although in the writer's opinion they are sometimes a little too lengthy.

The writer has had the pleasure of being in correspondence with the late Mr. Das on different points of systematical questions concerning Aphididae, and, through his courtesy, has received specimens of some of the new species, treated in this paper. Being therefore in the position of comparing my own notes on these species with the descriptions of Mr. Das, I have sometimes thought it necessary to add in short a few corrections or additions. In some cases I have thought it advisable to add in a separate note my own opinion on some questions of nomenclature or systematics. The original descriptions themselves have, however, been left untouched as much as possible.

In my opinion Mr. Das' paper will prove of great value to our knowledge of tropical and subtropical Aphididae, a subject which until very recently has been practically left untouched. His pioneer-work undoubtedly will give his fellow-workers many a good addition to their knowledge of this interesting group of little insects.

Salatiga, November 10th, 1916.

Lt.-Col. J. Stephenson, I.M.S., Principal and Professor of Zoology, Government College, Lahore, has kindly supplied the following biographical note:—

"Bashambar Das was born in 1884 at Nainakot, Gurdaspur district, where his father was a teacher in the local school. He received his early education at Rahon

in Jullunder district, and matriculated from the Doaba High School at Jullunder. After studying for two years at the Forman Christian College, Lahore, he passed the Intermediate Examination in Science of the Punjab University. He then joined the Lahore Medical College; but after two years, owing to a serious illness, he had to give up his studies just as he had passed the Preliminary Scientific examination. These two years served however to give him a good foundation for his biological studies later on.

“His educational career as a medical student having been thus unexpectedly cut short, he joined the Government College, Lahore, and obtained the degree of B.Sc. in 1908, taking as his subjects Botany and Zoology. He was the first to join the regular M.Sc. class in Zoology, which was started in the same year; and while thus engaged in his further studies he was appointed to a demonstratorship in the department. In 1910 he obtained a good second class in the examination for the degree of M.Sc. in the Punjab University.

“By this time his inclination for outdoor observation and aptitude as a naturalist had become fully established; he was a keen collector and student of insect life; and before taking up the study of a special group he had equipped himself as an entomologist by paying several visits to the Imperial Agricultural College at Pusa and the Indian Museum at Calcutta, where he carefully examined the collections and identified his own specimens. In 1912 he was appointed to the Provincial Educational Service as Assistant Professor of Biology in the Government College, Lahore, and now began to examine and collect plants with the same keenness and care which he had hitherto bestowed on animal life. He selected the Aphids for special investigation, since this group gave him the opportunity of studying the plant hosts as well as the insects themselves.

“He resolutely declined marriage till he should have done a sufficient amount of research work to submit a thesis for the degree of Doctor of Science. The thesis, now published in the present form, was presented in 1914; and both the examiners having expressed their approval of it as a sufficient qualification for the degree, its author would in the ordinary course have been invested with the degree in 1915, and would thus have been the first person to receive the Doctorate (except *honoris causae*) in the Punjab University. Unfortunately for Biological teaching in the Punjab, Bashambar Das died of an attack of cholera in May 1915, contracted while attending on two students suffering from the disease in the College Hostel.”

FOREWORD.

The studies on plant-lice embodied in this paper were chiefly carried out at Lahore, in the Government College Biological Laboratory, under the direction of Lt.-Col. J. Stephenson, D.Sc., Principal and Professor of Biology.

In order to consult reference literature and to examine any previous Aphid material, opportunities were taken for spending some time in the Entomological sections of the Agricultural Research Institute at Pusa (Behar) and the Indian Museum in Calcutta (Bengal). Shorter visits were paid to similar institutions at Lyallpore (Punjab), Dehra Dun (United Provinces) and Poona (Bombay).

Descriptive accounts and life-histories, so far as known, of forty species, new and old, belonging to eighteen different genera, have been dealt with. Plates and Camera lucida drawings accompany all, as well as the characters of genera and identification tables where necessary. A host-plant index has also been prepared and is given at the end.

With the object of facilitating further work on Aphids in India, an attempt is herein made to present in one place all information of this nature that exists concerning these insects in this country. Lines for additional investigations, therefore, and special points requiring more extended observation are indicated throughout.

Most of the theoretical considerations, as well as the measures for controlling such as are pests, have not been touched upon at all.

The relation of plant-lice to their environment, and in particular to their insect friends and enemies in India, could merely be given in some cases; their detailed account has been reserved for an independent treatment.

For the rest, taking into account the very scanty earlier knowledge on Oriental Aphids, it may be hoped that what is contained in the following pages would be of interest either as new, or recorded for the first time from India.

It would be of use to note, in this connection, that Lahore is situated in $31^{\circ} 35'$ N. and $74^{\circ} 20'$ E.; its height above sea level is 732 feet. The hottest months are May and June with a mean maximum temperature of about 106° ; the actual highest may go up to 120° . The mean minimum for the cold months of December and January is nearly 40° ; the actual lowest has never gone below 29° . The amount of rainfall ranges between eight and twenty-five inches, but is chiefly confined to the "rainy season" in July and August.

The time for shedding leaves differs in most of the deciduous plants, so that in the plains we do not have a "winter" preceded by an "autumn" or "Fall," when all the plants are devoid of foliage. Wheat and several other cereals are "winter crops"; when harvested in April no "volunteer wheat" remains in the fields.

INTRODUCTION.

Aphididae or plant-lice are soft-bodied, usually small insects belonging to the same large group popularly known as "bugs." Like them constituted to live upon liquid food only, they draw out their nutriment by puncturing the living parts of plants, by means of their suctorial beaks. It is due to their sedentary habits and quick multiplication that they are generally found in smaller or larger droves, most frequently upon the leaves and the tender shoots of their hosts. If the drain upon the juices is excessive, the plants are very much weakened, and even succumb to the injury.

Economic importance. Those therefore that attack the cultivated plants often assume an economic importance for the gardener and the farmer, necessitating vigorous, and in cases even elaborate, measures to be taken in hand to stop or stem the losses due to these pests.

Their biological interest and importance is no less great. They present several unusual and remarkable peculiarities in their structure and life-histories. Their study has attracted numerous workers, but still the group requires a thorough investigation from several aspects.

Biological interest. The popular English names for these insects are "green-fly blight" or "plant-lice." The German "Pflanzenlaus" is an exact equivalent of the latter, though equally often they are referred to as "Blattlaus" or "leaf-lice."

There is hardly any word in use in the Punjab to definitely designate a "*plant-louse*." Ordinarily the farmer speaks of it as "Tela" from "tel," meaning oil,

Vernacular name which has a reference rather to the effect of its presence
"Tela." upon the attacked plant. When clustering in large numbers on the young branches and constantly sucking the juice, the insects void out thin and clear saccharine excreta, known as "honey-dew," which falls in fine drops over the lower parts of the plant. These come together and smear the leaves, or flow down the branches. On drying up a little, this liquid takes the appearance and consistency of a syrup or a non-volatile oil with which the plant seems to be sprinkled over. Moreover, the branches thus wetted, and the smothered vegetation below these, when dried and ignited, burn as if they had been soaked in some inflammable material. Hence the propriety of naming it "Tela." But the indefiniteness about this name is that a similar effect may be caused by insects other than Aphids, and in that case the other insects are also termed "Tela." For instance we have "Mango Tela," which is a Psyllid; "Sugarcane Tela," that is an *Aleurodes*; or "Banyan (*Ficus bengalensis*) Tela," that may be a Coccid (*Monophlebus*).

In the United Provinces an individual Aphid is called by the agriculturists

“Maun” or “Mahun,” which is not an unfamiliar name in the Punjab either ; but I suspect it would about as commonly be applied to any small-sized, quiet-looking insect. Still, if either of these names is settled upon to signify a “plant-louse” in the restricted sense, it would, in my opinion, be almost as good as any to be newly coined for general use.

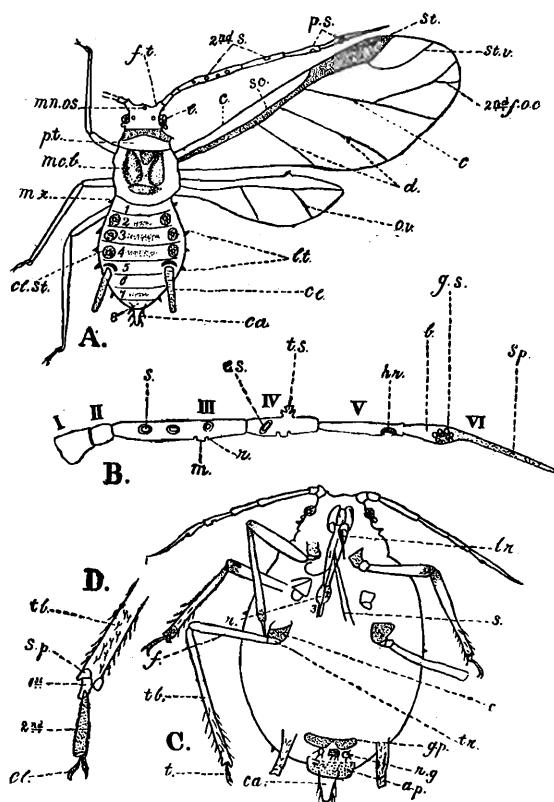


FIG. 1.—The Anatomy of an Aphid (diagrammatic).

A. Alate viviparous female.

C. Apterous viviparous female.

B. Antenna.

D. Tarsus.

e.=eye; f.t.=frontal tubercles; 2nd s.=secondary sensoria; p.s.=primary sensoria; mn.os.=medium ocellus; pt.=prothorax; mc.b.=mesothoracic bosses; mx.=metathorax; cl.st.=carinal spot; ca.=cauda; ce.=cornicle; l.t.=lateral tubercles; o.v.=oblique vein; c.=costa; sc.=subcosta; d.=discoidals; cb.=cubitus; 2nd f.o.c.=2nd fork of cubitus; st.v.=stigmal vein; st.=stigma.

s.=sensorium; m.=membrane; r.=rim; e.s.=ellipse sensorium; t.s.=tuberculate sensorium; h.r.=hair rim; b.=base; g.s.=group of small sensoria; sp.=spur.

lr.=labrum; s.=setae; r.=rostrum; f.=femur; tb.=tibia; t.=tarsus; ca.=cauda; a.p.=anal plate; r.g.=rudimentary gonapophyses; g.p.=genital plate; tr.=trochanter; c.=coxa.

tb.=tibia; s.p.=sole pustule; 1st.=1st joint; 2nd.=2nd joint; cl.=claws.

Though aphids are normally present during the main part of the year, yet a casual observer often overlooks them on account of their small size and lack of bright colouration. Their presence is indicated, and may at least be inferred from some of the following circumstances:—

General conditions of Aphid attack.

- (1) The leaves of an infested plant may be deformed in some way, either twisted, contorted, arrested in growth or changed into true pseudo-galls.

- (2) Its general appearance may be sickly and the lower foliage smeared with an oily liquid over which a deposit of fine dust renders it still more unsightly.
- (3) This liquid serves as an excellent culture medium for the growth of the sooty fungus *Capnodium*, sometimes only in its "Fumago" stage. The latter forms black smoky incrustations over the leaves, blocks their light, and on drying up scales off in thin flakes. The more abundant the excreta or "honey-dew" of the aphids, the greater is the growth of the fungus. Whole fields may thus be blackened and smothered in some cases.
- (4) Predaceous insects such as Coccinellids (ladybird-beetles) may be noticed in the vicinity, and these insects always possess conspicuous, warning colours. Their shape, like half a pea, is also characteristic. Syrphid flies, too, hover about the infested plants in order to deposit their white eggs, and can be recognised by their bright banded abdomens.
- (5) A very sure sign again is the presence of ants coursing up and down the plant. Even when there are just a few aphids hiding themselves under a leaf, ants would discover them much quicker than any trained collector of insects. Ants are too notoriously fond of sweet things, and seek out the plant-lice for the "honey-dew" they discharge. To this fondness may be ascribed those extraordinary relations existing between ants and aphids into which at present we need not go. Lubbock, Büsgen, Forbes, Mordwilko, Wheeler and Webster have written on the subject.

Like the majority of other Hemipterous insects plant-lice do not undergo any true metamorphosis. The normal course of their life-history in Lahore, with slight variations, is about the same as in other countries, and may be briefly told as follows:—

Eggs.—The eggs are deposited during winter from any time in December to late February. They are long oval in form, varying in length from 0.5 mm. to 1.5 mm., and are generally laid scattered near or upon the host buds, but in some forms as clusters also. The light colour of the freshly laid egg soon changes into shining jet black, a characteristic of the aphids.

The hatching period extends from late February to about June in some species. The insects that emerge are wingless, and remain so till maturity, that is fifteen or twenty days later, when they begin to reproduce parthenogenetically. Several broods of similar "asexual" or "agamous" females, all giving birth to live young, may follow, and are spoken of as "apterous viviparous females."

Stem-mothers.—The original females from which the later generations spring are called "stem-mothers" or "Fundatrix."

Ecdyses.—The time taken by each female, from its birth to the age when reproduction begins, differs according to season and species from four or five days to twenty or more. During this interval there are usually four or five "ecdyses" or skin-moult.

Pupae.—After one or more broods of apterous females the young that are born soon develop stumpy elevations on either side of the two hind thoracic segments, known as “wing-pads,” such individuals are somewhat incorrectly referred to as “pupae.” Their backs in many cases are ornamented with spots of white pulverulence.

Alate viviparous females.—At the final moult the pupae change into winged insects, which for all practical purposes are considered equal to the imagines of other insects. They are not equivalent to them, however, because they also reproduce asexually, and are termed “winged” or “alate viviparous females.” They fly off or migrate to other plants of the same species, thus assisting in the dispersal of the colonies, or to a different or “alternate host” which may form a necessary part of the life-cycle. Lichtenstein employed the word “Pseudogyna” for all apterous or alate viviparous females.

In Lahore plant-lice that hatch early in March multiply very actively till about June and then disappear. Their disappearance is partly due to enemies and the heat, and partly to the diminished flow of sap in the plants during the hot summer. Some go to other hosts, others migrate to cool moist places, still others probably lay eggs before the setting of summer. After the rains in September they are again found on their hosts; those that come back from different plants are called “return migrants.”

Sexuales.—From September onwards, during October and November, there is again a period of very active increase in their numbers. Late in November or early in December the true sexes develop. The offspring of the last generation of viviparous females either become males or egg-bearing females, and are referred to as “sexuales.”

Males.—The males may be winged or wingless; a third stumpy kind was also discovered in one species. One, two, or all the three kinds may be found in the same species. They are readily recognised by their anal end having a well-developed “genital armature,” consisting of a curved central penis and two triangular lateral pieces (see below under *Shivaphis*). Their bodies are more slender, darker than ordinary agamic individuals; sometimes they are dark pinkish in colour; all the antennal joints are characteristically full of secondary sensoria, their number being much in excess of those on the antennae of alate viviparous females.

Females.—The oviparous females are somewhat fusiform, and contain eggs instead of embryos. They are very often pinkish, yellowish, or otherwise differently coloured to the apterous females, which in other respects they resemble. The chief distinguishing character is the smaller size of their hind legs, which are also swollen and covered over by numerous small irregular sensoria. Unlike the males no additional sensoria are developed on the antennae. The hind legs are known to be employed for oviposition in suitable situations.

In a few forms sexuales are said to possess no functional mouth parts, that is the beaks are atrophied.

After pairing the eggs are deposited to start the life-cycle again. Most of the

eggs are sterile and never hatch; this is due to the males often being produced much in advance of the females, which thus do not get a chance of mating and deposit unfertilised ova.

[A summary of the systematic position of the Aphididae and an account of their general anatomy has been withheld from this paper, in order to diminish its size. The names for the different parts of the aphid-body, as used in this paper, are sufficiently indicated in the drawing (fig. 1) at the beginning of this introduction. The student of Aphididae may find more elaborate particulars on aphid-anatomy, etc. in several recent publications of European and American writers (Tullgren, Mordwilko, Börner, etc.). P. v. d. G.].

All the knowledge we possess of Indian plant-lice is confined to a few stray notices in the *Indian Museum Notes* published up to 1903. A summary of these, with some additions, is given by Lefroy in *Indian Insect Life*, p. 747 (1910), with a list of twenty-one definitely recorded Indian species, including even those that occur outside the plains. Besides these eleven more are listed for the tropics by van der Goot in a paper on two undescribed Javanese Aphids, published in Holland in 1912. Otherwise there is rarely ever a reference to Indian forms in European or American literature.

The identifications in the *Indian Museum Notes* in almost all cases are by Buckton, who appears to have been, at the time the specimens were submitted to him from Calcutta, either preoccupied by other work, or to have given up doing the Aphids.

Though later methods of description have necessitated a thorough rewriting (being undertaken at present by Prof. Theobald) of even his monumental work on British Aphids—the latest complete monograph of the family—yet the accounts he furnished of Indian insects are too summary to be of much value, and are accompanied in most cases by indefinite and incorrect illustrations. An overhastiness is apparent in proposing new genera and species, and against their too brief characterisation a protest was entered at that time by W. W. Frogatt in the *Indian Museum Notes*, vol. V, no. 3, p. 111. His *Ceylonia theaecola*, new genus and new species, (*Indian Museum Notes*, II, p. 34) for instance is the same as *Toxoptera aurantii*, Koch 1847, reviewed by Buckton himself in *British Aphids*, vol. IV. *Chaitophorus maculatus* (Buckton) is identical with *Callipterus trifolii* (Monell); *Lachnus fuliginosus*, Buckton, is created out of mixed material of *Lachnus viminalis* (Boyer) and *Dryobius persicae* (Cholod.), and so on.

The additional species listed by Lefroy are determinations by H. Schouteden, whose correspondence I was kindly permitted to examine at the Agricultural Research

Institute at Pusa. Unfortunately all duplicates of the specimens sent to Schouteden were altogether lost, as they could be found nowhere in the collections. Therefore a verification of the names of these aphids is practically impossible except indirectly. *Aphis adusta* (Zehnt.), for example, we now know to be a synonym of *A. maidis* (Fitch). *A. cardui*, L. on *Vicia* sp. and *A. rumicis* on *Vigna catjang* are probably both *A. medicaginis* (Koch).

Thistles of the genus *Carduus* are foreign to the Indian plains, their place being taken by species of *Cnicus*, which are only infested by *A. rumicis*, L. *A. cardui*, L. I have never so far collected from any part of India, nor have I come across *A. rumicis* on any Leguminous plant. *A. medicaginis* (Koch) possesses certain characters in common with both these species, but is quite distinct, papilionaceous herbs and shrubs forming its most favourite hosts.

Schouteden has described no new species from India, but had placed query marks against several as doubtful.

Thus, useful as it is, the list given by Lefroy can only be accepted as accurate with a certain amount of reserve.

Very few collections of Aphididae have been made in this country, and most of those in the possession of the Indian Museum, Calcutta, are at present said to have been sent away for identification. But formerly there was hardly a single entomological collection or museum, known to me in India, where one could go and find even half a dozen species of properly-determined aphids. Such a state of affairs, though not undesirable from certain points of view, acts as a serious initial difficulty in the way of a student.

Another almost insurmountable obstacle that a student in India encounters is the deplorable lack of up-to-date literature on this family. Ordinary libraries do not pretend to supply it, and in the best libraries expected to possess literature, *i.e.* those at Pusa and Calcutta, it was not so well represented as it ought to be, and perhaps could not be unless specially ordered. The literature is widely scattered in numerous journals, and in many different languages, and often being out of print is unobtainable through the book-sellers. This want we have in part met by procuring for the libraries of the Punjab University and Government College most of the recent works on these insects, either through the research grant from the Government or through the courtesy of Western Aphidologists.

In Lahore one is handicapped by the lack of even a convenient local flora for ready reference to the names of plants, which is quite an essential factor in the study of plant-lice.

Besides these extraneous difficulties the systematic study of this family has some peculiar disabilities of its own. In spite of the partiality shown towards these insects **Difficulties in the group** by distinguished workers for a long time, the sad reproach **itself.** in the words of a well-known entomologist (Lefroy) "that the classification of Aphids is a disgrace to Entomology" is perhaps too true: pains are no doubt being taken by some modern authors to remove this reproach.

With a full knowledge of the difficulties mentioned above, an attempt has been made to start a preliminary study of the Indian species of this important group of insects. A part of the result, with whatever shortcomings it may inevitably have, is presented in the form of this paper.

A list of the Lahore Aphids, dealt with in this paper, is given below; a host index for these will be found at the end of the paper.

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| I. <i>Pemphigus</i> . | (1) <i>aedificator</i> (Buck.). |
| " | (2) <i>cynodonti</i> , n. sp. (on <i>Cynodon</i>). |
| II. (a)— <i>Macrosiphum</i> . | (3) <i>rosaeiformis</i> , n. sp. |
| (b)— <i>M</i> . | (4) <i>solidaginis</i> , Fabr. |
| (c)— <i>M</i> . | (5) <i>sanborni</i> (Gil.). |
| (d)— <i>M</i> . | (6) <i>granarium</i> (Kirby). |
| (e)— <i>M</i> . | (7) <i>pisi</i> (Kalt.). |
| III. <i>Rhopalosiphum</i> . | (8) <i>lactucae</i> (Kalt.). |
| IV. <i>Myzus</i> . | (9) <i>persicae</i> (Sulzer). |
| V. <i>Phorodon</i> . | (10) <i>cannabis</i> , Pass. |
| VI. (a)— <i>Siphocoryne</i> . | (11) <i>avenae</i> (Fabr.). |
| (b)— <i>S</i> . | (12) <i>indobrassicae</i> , n. sp. |
| (c)— <i>S</i> . (= <i>Siphonaphis</i> , v.d. Goot). | (13) <i>nymphaeae</i> (Linn.). |
| VII. (a)— <i>Brevicoryne</i> (n.g.). | (14) <i>brassicae</i> (Linn.). |
| (b)— <i>B</i> . | (15) <i>coriandri</i> , n. sp. |
| (c)— <i>B</i> . | (16) <i>chenopodii</i> (Schrank). |
| VIII. <i>Stephensonia</i> (n.g.). | (17) <i>lahorensis</i> , n. sp. |
| IX. (a)— <i>Toxoptera</i> . | (18) <i>graminum</i> (Rond.). |
| (b)— <i>T</i> | (19) <i>cyperi</i> (v.d. Goot). |
| (c)— <i>T</i> | (20) <i>punjabipyri</i> , n. sp. |
| X. (a)— <i>Aphis</i> . | (21) <i>rumicis</i> , Linn. |
| (b)— <i>A</i> . | (22) <i>medicaginis</i> , Koch. |
| (c)— <i>A</i> . | (23) <i>sacchari</i> (Zehnt.). |
| (d)— <i>A</i> . | (24) <i>maidis</i> (Fitch). |
| (e)— <i>A</i> . | (25) <i>gossypii</i> (Glover). |
| (f)— <i>A</i> . | (26) <i>malvae</i> (Koch). |
| (g)— <i>A</i> . | (27) <i>malvoides</i> , n. sp. |
| (h)— <i>A</i> . | (28) <i>durranti</i> , n. sp. |
| (i)— <i>A</i> . | (29) <i>nasturtii</i> (Kalt.). |
| (j)— <i>A</i> . | (30) <i>nerii</i> (Boyer). |
| XI. <i>Brachycaudus</i> . | (31) <i>pruni</i> (Koch) or <i>helichrysi</i> (Kalt.). |
| XII. <i>Hyalopterus</i> . | (32) <i>pruni</i> (Fabr.). |
| XIII. (a)— <i>Brachyunguis</i> (n.g.). | (33) <i>letsoniae</i> , n. sp. |
| (b)— <i>B</i> . | (34) <i>harmalae</i> , n. sp. |
| (c)— <i>B</i> . | (35) <i>carthami</i> , n. sp. |
| XIV. <i>Eichochaitophorus</i> . | (36) <i>himalayensis</i> , n. sp. |
| XV. <i>Callipterus</i> . | (37) <i>trifolii</i> (Monell). |
| XVI. <i>Shivaphis</i> (n.g.). | (38) <i>celti</i> , n. sp. |
| XVII. <i>Tuberolachnus</i> . | (39) <i>viminalis</i> (Boyer). |
| XVIII. <i>Tuberodryobiis</i> (n.g.). | (40) <i>persicae</i> (Cholodk.). |

Pemphigus (?) *aedificator* (Buck.).

Host.—*Pistacia integerrima*.

Vern. "Kakkar"; the gall is known as "Kakkar Singi."

The insect may be readily recognised by the characteristic horn-like galls into which it converts the leaflets of the abovenamed species of *Pistacia*. From May to October they may be observed as straight or curved pod-like structures, generally at the terminations of branches. They are either wholly green or partly pinkish and contain

innumerable yellow plant-lice, covered over by a white flocculence secreted by six rows of wax-glands on their back. The galls ripen in November; the tips of the galls are generally narrow and imperforate and their curved shape, in most cases, makes them look like miniature horns, hence the vernacular name "Singi" from sing (= horn). From a crack or a slit on one side of a ripe gall the insects, that have in the meantime developed wings, emerge in swarms at this time. The empty galls turn brown and woody. They may remain hanging on the tree for more than a year, and are conspicuous objects in winter when the tree is devoid of green foliage.

These galls are supposed to form a valuable drug which is officinal in the Indian Pharmacopeia; it is sold in the bazaar at one anna per ounce and is prescribed in pulmonary and intestinal disorders of children. Reference to this commercial article may be found, besides many Indian works, in Watt's *Dictionary of Economic Products*, vol. VI, p. 268 and Stewart's *Punjab Plants* of 1869, page 47. Both these writers express their ignorance about the insect concerned in its manufacture.

In 1891, C. F. Elliot first observed swarms of flies leaving the galls in November at a place called Harnai (Baluchistan), about 3,000 feet above sea level. The tree on which he noticed them was, according to him, *Pistacia terebinthus*, but that probably is a mistake as "Kakkar Singi" galls are only formed on *P. integerrima*.

The specimens were sent to the Indian Museum in Calcutta and thence forwarded to Buckton, who, as usual, gave a new name to the insect, but supplied an altogether too brief description of it, and even that in several points quite wrong. The faint and obscure illustration that accompanies the description conveys little more than that the insect figured is an "Aphidine" one. The antenna is shown as made up of eight or nine joints whose relative lengths cannot be discerned. It is stated that no sensoria are present! (*Ind. Mus. Notes*, vol. III, no. i, pp. 71-73).

The apterous viviparous female has not been mentioned at all.

Though we find that Buckton gives a fairly accurate account of the form, size, texture, contents, etc., of a dry gall, it was neither known to him nor was it suspected by the authorities at the Indian Museum that it was identical with the well-known "Kakkar Singi."

Except for a passing observation in Tullgren's systematic work on *Pemphigina* (1909) there is no record of the Aphid in current literature. It is probably for the first time here that the true insect and the drug have been connected. The problem was being investigated independently on a few *Pistacia* trees in the Botanical Gardens, where the development of the gall was thoroughly followed. On comparison it was later discovered that the insects were in every respect the same as those originally collected by Elliot and preserved in the Indian Museum in Calcutta.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body oval or ovate; posterior end frequently tucked in telescopically.

Colour bright yellow to yellowish-orange; in old individuals even deep orange. Legs and antennae hyaline.

The insects are clothed with white powder, large quantities of which collect at one end of the gall. It is secreted by rounded dot-like glands, situated along the dorsum in rows, two of which are medial and two on either side lateral. There are only four glands on the head and a conspicuous one in the centre of the anal plate. None are to be found ventrally.

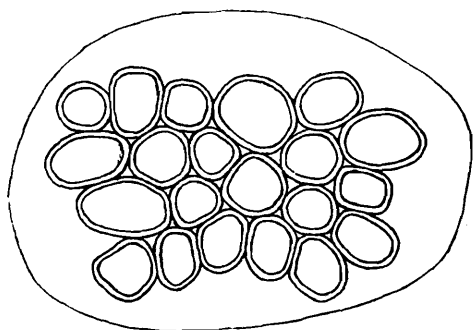


FIG. 2.—*Pemphigus aedificator* (Buck.).
Wax-plate with facets of apterous female, $\times 890$.

Head small, concolorous with body, or slightly darker, without frontal tubercles. Eyes very small and black. Antennae short and stout, about one quarter the length of the body, composed of five joints only.¹ Article I is gibbous, subequal to II but much thicker. Spur blunt, thickened at apex which ends in a few short stiff hairs; if the sensorium

be counted with it, the spur is almost half as long as the base.²

Length proportions :—

	I.	II.	III.	IV	V
	30	28	43	40	60+27
Lengths	0.050;	0.049;	0.067;	0.065;	0.100+0.048 mm.

The primary sensoria on articles IV and V have distinct hair-rims.

Lateral tubercles are conspicuous as black dots on carinae; in macerated glycerine mounts they come out like big sensoria.³

The glands consist of a larger or smaller number of polygonal or circular plates with a few dots on each. The plates have no definite arrangement in their grouping and sometimes appear as if depressed below the general surface. They secrete thready white flocculence which later turns powdery.⁴

The cornicles and cauda are absent.

¹ [Stem-mothers have only 4 joints to their antennae; the body is darkish (after note by Mr. Das). P. v. d. G.].

² [In giving measurements of the spur most writers agree in counting the sensorium as belonging to the base of the last antennal joint. P. v. d. G.].

³ [In specimens of apterous females, which I received from Mr. Das, I could not find any trace of "lateral tubercles," which by the way would be a unique fact if occurring in this genus. Perhaps Mr. Das may have mistaken the stigmata for "tubercles?" P. v. d. G.].

⁴ [To this description of the wax-glands of *P. aedificator* a few corrections ought to be added.

The different technical terms, as given by Mr. Das, are not quite correct. In accordance with Börner, who furnished a very complete description of the wax-glands of the Chermesinae, the wax-glands of Aphididae are cylindrical hypodermic cells. In slides these glands show like circular or polygonal figures with a chitinous outlining, called *facets*. These facets are mostly grouped together on more or less distinct and chitinous plates, called the *wax-gland plates*. The waxy flocculence is secreted through very small pores in the membrane of the facet, the so-called *wax-pores*.

In the apterous female of *P. aedificator* the wax-plates are not chitinized, but still are quite distinct from the rest of the integument because of their surface being quite smooth, not striate like the rest. The facets are circular or semicircular, lying quite close together, their number varying from 20 to 60 on each plate. A "*plate-hair*" is always wanting. P. v. d. G.].

The "anal end" is characteristic on account of a large rectangular almost vertical anal-plate, outlined with dark stiff hairs; its centre is occupied with a prominent wax-gland¹, the secretion from which flows like a tail behind the insect. The anus is raised upwards and is placed almost on the dorsal surface, forming a semicircular opening. Ventrally there is a black crescentic genital plate with its concave end facing backwards.

The rudimentary gonapophyses are conspicuous as two rounded dots, beset with a few hairs to each.

Legs very small; tarsi long, about half the size of tibiae.

Rostrum short and stout; it reaches up to about the third coxae, because all the legs are situated close together. Its three segments are subequal; the last one black-tipped and triangular.

Measurements (average) :—

Length	1.50 mm.
Breadth	0.82 ,,
Antennae	0.38 ,,
Tarsus	0.06 ,,

The pupae, which develop about October, are very similar in appearance to apterous viviparous females. They are quite yellow and tassellated with glands as usual; they only change colour when approaching their final moult in November. Slowly the dirty greenish tinge invades the thorax and abdomen. The shoulders are whitish.

Alate viviparous female.—Body elongate oval; dull black or very dark green. Head, antennae, prothorax, legs and rostrum black; mesothoracic bosses large and shining black. The white powder forms only a thin layer over the surface.

Head broad, without frontal tubercles, with two or three depressions on vertex; front bilobed with a median groove. Eyes and ocelli well developed, black. Antennae short but relatively a little longer than those of the apterous female. Unlike the latter the number of articles here is six. All the joints are narrow at the base and gradually widen towards their distal ends. The spur is about half the base of VI.²

Length proportions :—

	III.	IV	V.	VI.
	16	11	13	21
Lengths	1.33	0.95	1.01	1.70 mm.

Sensoria rather large, without hair-rims, except the primary ones; the form is various, from somewhat broad or long oval to irregular circular or even dumbbell-shaped in some. They are not tuberculate; the membrane is almost flush with the

¹ [I have been unable to discover any "wax-glands" (= group of facets) on the anal plate. P. v. d. G.].

² [The measurement of the spur as given by Mr. Das is not quite correct; its length is only $\frac{1}{4}$ of the base of joint VI. P. v. d. G.].

surface of the antenna. There are occasionally one or two hairs arising from it, whose bases may be seen as white dots. As they are crowded at the apex of the joint that part looks swollen. Their number is from four to six (4-6) on article III; from two to three (2-3) on IV and only one or none besides the primary on V

Prothorax sharply defined from the head, broad rectangular in outline; it carries a blacker stripe on its anterior edge.

Mesothoracic bosses large, flattish, of the usual form; so is the metathorax with its one semilunar median, and two triangular lateral black spots.²

Wings ample, much longer than body; grayish-white with thin brown veins.

Stigmal flattening large and inflated, rhomboid; its posterior border continues along the subcosta as a thick black band, the centre is occupied again by a black elongated spot. A thin false vein passes behind the stigma right up to the insertions as illustrated. The stigmal takes its origin from the latter and reaches the margin almost straight with a very slight curve. Cubitus simple and obsolete at base.

First and second discoidal veins arise in most cases as a result of the forking of a common trunk, springing from the basal third of the subcosta, which is rather unusual. The hind wing also is relatively large with two normal oblique veins.³

Abdomen ovalish, strongly arched and distended, due to the presence within of a large number of young ones. Lateral grooves and carinae come quite near each other, but at the sides the segments are separated by shallow grooves which impart to the edges a wavy or festooned appearance.

Colour very dark dirty greenish; glands similar to those of the apterous viviparous female; cauda and cornicles absent.

Anus dorsal; anal and genital plates as in the apterous female. Rudimentary gonapophyses as two very conspicuous, rounded, spiny processes between the plates.

Legs longer and blacker.

Rostrum similar, but reaches only very little beyond the first coxae.

Measurements :—

Length	2.20 mm.
Breadth	0.50—0.60 mm.
Antennae	0.60 mm.
Wing expanse	6.50 „
Wing	3.0 × 0.60 mm.

Natural History.—The winged females issue forth in large swarms from cracks or holes in the pod-like galls. In Lahore this begins about the third week of October and continues throughout November. The colonies inside the galls, which were kept

¹ [The small hairs mentioned by Mr. Das do not arise from the membrane of the sensorium, but from the integument itself on the opposite side of the joint. P. v. d. G.]

² [The mesothoracic bosses are indistinctly separated; the mesothorax, therefore, is simple, not three-lobate.

Mr. Das does not mention a marginal group of facets on each side of the prothorax and two spinal groups on the middle of the metathorax. P. v. d. G.]

³ [Unfortunately Mr. Das does not mention in what way the wings are carried under normal conditions. P. v. d. G.]

somewhat protected inside muslin bags, ripened in some cases as late as the middle of December, but the majority of the galls are quite empty long before this time. Occasionally some yellow apterous viviparous females are also seen reproducing at the time, but the last generation all change into pupae and ultimately fly out, the apterous females dying a natural death.

These winged females are very impatient to discharge their load of young and even on a slide they would expel a few of them by strong peristaltic movements of the abdomen. Inside the muslin bags the tiny young crawl about for a day or two, and may even moult once, but they soon die, as they absolutely refuse to take nourishment either from the gall or from the *Pistacia* leaves. Evidently it is some other plant to which the winged females migrate and on which the young can thrive. During the little spare time I had outside official duties, I made several attempts to determine this alternate host. It is recorded of the European species of *Pemphigus* (on *Pistacia*) that they spend a part of their life history on graminous plants. Taking a hint from this, several grasses and similar weeds were enclosed in cages containing alate migrants issuing from galls, but in no case was the artificial colonisation successful, and the young plant-lice died after their first moult.

From certain anatomical resemblances it was strongly suspected that the insect provisionally described below as *Pemph. cynodonti*, n. sp. may be the alternate form. Its time of appearance in early October more or less coincided with the ripening of the galls. But as colonising experiments gave negative evidence no definite proof can be adduced to maintain this hypothesis. It may be expected that with increased vigilance and better opportunities for conducting field and indoor observations the alternate host of this important insect will soon be ascertained. Till then our knowledge of its life-history must remain incomplete. As at present known it is as follows:—

Life-cycle.—The foliage buds of *Pistacia* open about the latter half of February, some fifteen days after those that contain shoots of inflorescence. Almost simultaneous with the appearance of the tender pinkish leaves tiny protuberances—the future galls—are visible at the bases of the leaflets. These all enclose one darkish aphid each, hatched from the egg, laid some time previously upon the bud. As the leaves mature the galls grow and the aphids within (stem-mothers) multiply; yellow apterous females are born that reproduce again parthenogenetically. This continues from March to October when the galls ripen and the last generation of plant-lice change into pupae, ultimately becoming the winged insect in November which migrate to some other plant.

The points requiring elucidation are:—

- (a) What is the plant or plants to which the insects go.
- (b) When are the sexuales developed.
- (c) What time do the “return migrants” come back to *Pistacia*.

It must be these latter that deposit the eggs, which hatch out again in early March to start fresh colonies in the galls.

Possible connection with Pemphigus cynodonti.—From *Pemphigus cynodonti*, n. sp.

it differs in several important respects both in the apterous and the alate form. The colour, size, number of antennal joints of the apterous female and the sensoria and wings of the alate form are dissimilar in the two.

The *Pemphigus* on *Cynodon* is apterous throughout winter and spring, forming winged individuals only in late April or early May. Their further history is obscure. They were never observed on grass from May to October, nor were they ever noticed on *Pistacia*. If in spite of these differences any connection between these two species is established later on, a complete life-cycle might be expected to be somewhat like this:—

The eggs hatch into stem-mothers in March and found new colonies within the galls containing apterous females till October; in November the aphids leave the galls as winged viviparous females. From November to April or May of the following year the generations are all wingless; in May they would go to *Pistacia* as alate females but viviparous again; the progeny of these would, at some time from May to November or December, develop the sexual individuals that would lay eggs in the buds. These wintering over must hatch again in March. Thus the life-cycle would extend over at least two years, but this remains to be established.

Formation of the galls.—The leaves of *Pistacia integerrima* are compound ones as shown in the accompanying reduced drawing (pl. xiii). Each possesses a long peduncle, having five or six pairs of nearly sessile leaflets. Almost invariably it is the top-most leaf of a branch on which the galls develop, and therefore are always terminal. At a time when the leaflets are very young and the peduncles hardly elongated at all, the stem-mothers hatch from the eggs and fix themselves near the bases of the leaflets on their upper surface. In a manner very similar to what is seen in some Psyllids, they make a depression which bulges as a conical projection ventrally. This pit, by constant irritation, grows larger and its top slowly closes up, so that there is now a closed finger-like process on the underside of the leaflet, in which the stem-mother is enclosed. These are the future galls, and there may be as many as six or eight on one compound leaf: ordinarily their number is limited from one to four, the commonest number being two as shown in the figures. The leaflet on which the gall develops soon atrophies; other leaflets may grow even to their normal size, but generally remain stunted.

The first effect of gall-formation on a leaf is the arrested growth in length of its peduncle which usually becomes thickened and curved downwards, so that the leaflets and the growing galls are situated quite close to each other. If the leaflets drop off early the galls become terminal.

Growth.—The galls grow very slowly at first, but in about two months' time they attain a length of two or three inches; in breadth they vary from $\frac{1}{6}$ to $\frac{1}{4}$ of an inch. In the shade the colour remains green, but the portions that are exposed to the sun turn partly pinkish. The inside is perfectly smooth, pink, and dusted with white powder from the backs of the insects. This powder when abundant collects in the lower end of the gall, and protects the insects from becoming wet with their own liquid excreta, which trickles in white drops.

Large resin ducts enter the walls, and the substance readily exudes if they are injured; it moreover often congeals on the outside and possesses a characteristic odour.

The number of plant-lice inside at this time is about twenty, but later the number increases excessively. The gall shows a steady growth during the rainy months of July and August. In late September it is mature.

Form.—At this time it has quite the appearance of a straight or curved leguminous fruit, and is popularly referred to as a "Phali," the vernacular for a pod. This "pod-gall" is either uniform in thickness or partly swollen and partly very thin; distally it usually narrows into a hard imperforate beak. The galls, which have become bent at an early stage, maintain their curvature even when dry, and are not unlike small horns: this resemblance has earned for them the vernacular name "Kakkar Singi" as already alluded to above.

Size.—The galls vary in length from five or six inches to about a foot; some of the largest galls are more or less straight and may measure up to an inch across. The usual thickness is about half an inch. The wall itself is from $\frac{1}{12}$ to $\frac{1}{10}$ of an inch thick in fresh specimens, and is soft and yielding as long as the insects are inside. The interior is always pink in colour, and is full of teeming aphids in countless thousands.

Opening of the galls.—Birds, squirrels as well as other animals at this time nibble at the fruit-like galls and cut holes into them. These holes are utilised by the winged insects as an exit. But even when such holes are absent the alate insects, by mechanical pressure of their beaks, can cause the galls to crack in places. This happens invariably in cases when the galls are protected in muslin bags.

Dry galls.—The empty galls on drying turn brown and woody, often getting twisted and contorted into various shapes, with cracks and slits on the sides. They remain hanging on the tree sometimes for considerable periods, and are packed with the white flocculent secretion of the aphids intermixed with the exuviae, wings and dead bodies of the insects. Some galls retain their pink colour.

They serve as excellent places for the hibernation of spiders and insects like Coccinellids, which are usually found inside them.

Enemies.—This aphid, well-protected inside the galls, is singularly free from the attacks of predaceous and parasitic insects. Late in the season when the holes and cracks are formed occasionally a Coccinellid gets entrance, and once or twice a *Chrysopa* has also been reared from them. No parasites were ever obtained.

Sometimes from a riddled gall the ants carry off the aphids as food, and it would not be surprising if it is found that at least some of the holes are due to the agency of ants. They can be easily seen cutting similar round holes in the large and persistent calyx of the fruit of *Withania somniferum* inside which *Aphis malvoides* sometimes resides.

Systematic.—The name *Pemphigus aedificator* we owe to Buckton, but as already remarked his descriptive account of the insect is extremely inadequate and defective. Evidently little pains were taken to ascertain the proper generic position.

From typical *Pemphigus* this aphid differs in several important respects.

- (1) The antennae of the alate females have article VI longer than III; the reverse is true for *Pemphigus* (Oestlund, *Aphid. of Minn.*, 1887).¹
- (2) The sensoria are more rounded than transverse.²
- (3) In the wings the first and second discoidals are formed by the forking of a common trunk.
- (4) The rudimentary gonapophyses are only two in number. The usual number in Pemphiginae is three (after Tullgren and van der Goot).
- (5) The apterous females have the antennae made up of five joints only.³

Such important and distinctive features perhaps require a generic separation from *Pemphigus* as defined at the present day. But as I have not had an opportunity of a detailed examination of this genus, I have refrained from proposing a new name, and left the insect under *Pemphigus*. The change may later on be introduced by better authorities on the subject, if considered necessary.

[The different characters of "*Pemphigus*" *aedificator* show that it is distinctly different not only from the genus *Pemphigus* but as well from the tribe Pemphigina, to which it has hitherto been considered to belong. With most characters in common with the Pemphiginae, this species principally differs in the number of rudimentary gonapophyses and the form of the mesothorax, both very important characters. As to my personal opinion, *P. aedificator* might perhaps be considered the "missing-link" between the tribe Pemphigina and some representatives of the tribe Hormaphidina, as for instance the species of the genus *Schizoneuraphis*, v. d. G.]

The characters of *P. aedificator* necessitate not only the erecting of a new genus but even of a new tribe. In remembrance of the late Mr. Das, my esteemed co-worker, I have the honour to propose the name *Dasia* for the new genus, *Dasiina* for the new tribe, with characters as follows:—

Tribe *DASIINA*, nov.

Only genus: *Dasia*, nov. gen.

Characters: those of the genus *Dasia*.

Genus *Dasia*, van der Goot, gen. nov.

(Type: *Pemphigus aedificator*, Buckt.).

Morphological characters:—

Body with distinct groups of wax-glands in the apterous as well as in the alate form. Facets of wax-glands circular or polygonal, lying close together; no central-facet present.

Mesothorax simple, without distinct bosses.

Eyes of the apterous female consisting of 3 stemmata only.

Antennae six-jointed, in the apterous form often 4- or 5-jointed. Processus terminalis distinct, but always shorter than half the length of the basal part of the ultimate joint. Primary sensoriae rounded, small, with distinct hair-rims. Secondary sensoriae oblong-ovate, broad, not longer than half the circumference of the antennal joint; hair-rim always absent.

Cornicles entirely wanting. Cauda obsolete. Anal-plate simple. Rudimentary gonapophyses 2 in number, distinctly separate, spiny.

¹ [The relative lengths of the antennal joints have no generic value. P. v. d. G.].

² [The sensoriae of *P. aedificator* does not differ much from those of other true *Pemphigus* species, such as *P. bursarius*, L., *P. spirothaecae*, Pass., etc. P. v. d. G.].

³ [In the genus *Pemphigus* only the fundatrices have 4-jointed antennae, exactly as is the case too with *P. aedificator*, according to Mr. Das. The virgogeniae of *Pemphigus* always have their antennae 5-jointed! P. v. d. G.].

Fore-wings with the media I¹ simple; media II and cubitus with a short common trunk. Hind-wings with 2 transverse veins.

Legs well developed; trochanter not separated from the femur. P. v. d. G.].

It may be mentioned here that the insect under review has several structural characters in common with *Pemphigus* (?) *cynodonti* described below.

There is another similar *Pemphigus* infesting the leaves of the same *Pistacia* in the Punjab Hills near Kasauli. It forms only pseudo-galls by reflecting a part of the leaf over the rest of its surface. The alate females develop in July. The sensoriae on the antennae are more rounded and tuberculate; the wings, glands, etc., are alike, but rudimentary gonapophyses are entirely wanting.

All three species seem to fall in the same category though an entire lack of gonapophyses in one is rather a remarkable feature.

Pemphigus (?) *cynodonti*, sp. nov.

Host.—*Cynodon dactylon*.

Vern. Dub grass.

Locality.—River bank near railway bridge; canal bank in the Botanical Gardens.

Distinguishing marks.—In moist places, from November to March, one often notices some of the lowest suckers of *Cynodon* very much stunted in growth, pale yellowish, and in places pink-coloured. All the leaves are much smaller than normal ones and hypertrophied breadthways, while they appear to arise in a bunch, due to arrest in the growth of internodes. Such pseudo-galls contain numerous dull green insects covered over with long threads of iridescent gray flocculence issuing from rows of glands on their backs. One such branch is shown in the accompanying sketch (pl. xiv, fig. 10) besides a normal healthy shoot. The ground below is sprinkled over with white pulverescence.

Only apterous viviparous females are generally met with. Six rows of glands on the body, those on the head having chitinous rings encircling them; absence of cornicles and visible cauda, very small rostrum and two rudimentary gonapophyses are further characters to distinguish this aphid. In winged females the cubitus is simple and the sensoria irregular.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body ovate to oval, stout, from light greenish to dull dirty green: in March individuals lose most of this green tinge and look almost whitish, even after removal of the ordinary clothing of white meal.

Long white threads are particularly abundant on the head and the anal end, where they flow into a thick tail. Each of these larger threads is made up of smaller ones that issue from cells below the chitinous layer of the body, see pl. xiv, figures 1 and 2.

A white powder is secreted, at least it is found over the whole body.

The posterior end is often tucked in.

¹ [I follow the nomenclature of veins as used by Tullgren and others; in this description *media* I = *cubitus*, *media* II = *first discoidal* and *cubitus* = *second discoidal* of Mr. Das' descriptions. P. v. d. G.]

Head flat, black, except the hinder edge touching the prothorax; three pairs of clear glands are situated above; the first almost on the front, and the third at the level of the eyes. The latter is the largest and lies on the line terminating the black portion of the head.

The glands have a chitinous ring surrounding them.

Antennae resting directly on the head, black, sparingly hairy; the spur is thick and large, about half the base of VI; first joint longer than second.

Length proportions :—

	III.	IV	V.	VI.
	12	6	10	11 + 5 (16)
Lengths	0.20	0.10	0.16	0.19 + 0.08 mm.

There is one sensorium at the extremity of V. On article VI there is another associated with a group of smaller ones. Both sensoria are strongly ciliated.

Prothorax of the body colour; lateral sides dusky, the duskiness invading the dorsal parts as well. There are two glands about the middle and two depressions a little on their outside.

Meso- and metathorax similar to the abdominal segments, only their lateral glands are larger and they themselves are narrower.

The abdominal pattern consists of six longitudinal rows of greenish to darkish glands; two are median, two latero-dorsal and two lateral. These dot-like glands are largest on the sides. On the ultimate segments there are only four; a pair on either side becomes confluent. A little below the carinae is a prominent row of black lateral tubercles, a pair for each segment.¹

Anus semicircular and raised to the dorsal surface.

The cauda is only a dark line, otherwise obsolete.

Anal plate very conspicuous, rectangular, standing vertical; spiny along the margins which are black. The central part, directed backwards, is occupied by a large gland which secretes the threads of flocculence, running into a tail.

Genital plate thick, crescentic, black.

The rudimentary gonapophyses are small and two in number.

The cornicles are entirely wanting.

Legs stout, black, including coxae; tibiae only about a quarter as long as femora; tarsi only slightly smaller than third antennal joint.

Rostrum short and stout, hardly reaches a little beyond the first coxae; all the three joints are subequal and black.

Measurements :—

Length	1.75—2.00 mm.
Breadth	0.95—1.15 ,,
Antennae	0.80—0.95 ,,

Alate viviparous female.—Winged insects are very rare; during two years that they were kept under observation it was possible only to secure a few in the last week

¹ [Very likely the presence of lateral tubercles, as stated by Mr. Das, is only an error. P. v. d. G.].

of April, 1914. That they were viviparous females was made out by dissecting young embryos from their bodies.

Body ovalish, with a much less covering of meal; colour dark green, almost black.

Head, antennae, thoracic bosses, sternum, legs and rostrum all black.

The antennae arise from pits on either side of the medially grooved front.

The antennal spur is large, its terminal part a little thicker and beset with a few spines.

Article III thickest and longest, unlike the apterous viviparous female.

Length proportions :—

	III.	IV.	V.	VI.
	15	6	8½	9+4 (13)
Lengths ..	0·25	0·10	0·14	0·15+0·06 mm.

Sensoria: 10-13 irregular sensoria are borne in a line on III and 2-3 on IV; their membrane is dotted and often two are united together.

The prothoracic edge anteriorly is black and flattens on either side into larger dots; there is also another smaller band on the middle.

The metathoracic bosses are shining black, rather flattish and broad.¹

Wings voluminous, hyaline, having brown veins; costa and subcosta including insertions black. The posterior edge of the stigmal flattening is dark gray and swollen uniformly. The stigmal vein exhibits a slight curve. The first and second discoidal arise from a common point; the cubitus is simple and obsolete in its basal part. The posterior wings have two oblique veins.

The abdomen bears the same pattern of glands, but they are small; the lateral sides are wavy due to the well marked segmentation.

Lateral tubercles are present as in the apterous female.

Anus dorsal; the narrow ridge-like cauda and black vertical anal plate are all similar to those of the apterous viviparous female described above.

Legs a little larger, otherwise similar.

Rostrum short and thick, just reaches to the middle of first and second coxae.

Measurements :—

Length	..	..	..	1·70—1·80 mm.
Breadth	..	..	..	0·70—0·80 „
Antennae	..	..	..	0·85—0·95 „
Wing expanse	..	..	..	7·50 „
Wing	..	..	..	3·10 × 1·85 „

Glands —These are in most cases circular or flattened oval in form; in young females about to moult they assume a dark colour and are very clearly marked on the cast-off skin. Each consists of a smaller or larger number of rounded or somewhat angular facets, on which the hypodermal glands open and pour their secretion in the

¹ [Mr. Das does not mention if there are any wax-glands present on the thorax which is very likely to be the case here. P. v. d. G.].

form of very fine threads. These unite to make thicker threads which may grow as long or longer than the body of the insect. The largest amount of secretion occurs near the head and the anus. The glands in surface and profile views, along with the secreted threads, are shown in the accompanying figures (pl. xiv). They do not possess any central large facet as found in *Schizoneura*, nor is the group of facets comprising a plate surrounded by any chitinous ring as is said to be the case in the type for the genus *Pemphigus*.

Three pairs of glands on the head of the apterous female are composed of a smaller number of facets and encircled by clearly marked rings. On the background of the dusky head they appear like ocelli.

Life-history.—Malformations on grass (*Cynodon*) shoots are first noticeable about October or November.

The woolly plant-lice are all apterous and reproduce very quickly; if fresh growing shoots are provided to them in pots or glass vessels, they arrest the growth of these shoots at once and convert a normal branch into a sickly cluster of small leaves.

Throughout winter reproduction continues, slackening a little in January and early February. In March again the grass in most localities is covered over by thin flakes of waxy material, looking like cotton wool, and the insects are abundant. In April the apterous females have a much lighter colour, almost whitish; the progeny of these develop into pupae and some of them ultimately succeed in becoming winged adults. The winged females are parthenogenetic as evidenced by the presence of young embryos in their bodies, but they were not observed to reproduce on grass. Apparently they fly off to some other host that is at present unknown.

Natural enemies like *Scymnus* spp. and *Brumus suturalis*, Aphis-lion and some Syrphid larvae are very active amongst them on warm days. The aphids are present in shaded places and preferably on branches that are covered over by a debris of dry leaves. The predaceous insects, however, hunt them out very actively, so that it is only during a week or two when they may be collected. After the first week of May none at all is visible. How and where the life-cycle is spent from May to October I have been unable to find out.

This species resembles in many important features the one found on *Pistacia integerrima* and described above as *Pemph. aedificator*, Buck. As both are present in the same locality, it was suspected that it might prove to be the migratory form of *Pemph. aedificator*, and experiments were undertaken to discover the relation. Twice from November to April the species were kept under observation both in the field and the laboratory, and several attempts made to transfer the winged forms of the one to the other, but they all failed.

The alate migratory females from *Pistacia* galls did not reproduce young on *Cynodon* under glass chimneys. Alate forms from *Cynodon* could not be colonised on *Pistacia* leaves. So very probably the two forms have nothing to do with each other, though some further and more accurate observations would be required to establish this point.

Systematic.—The two insects, otherwise from their structural anatomy, are quite distinct from each other. The colour, antennae, sensoria and stigma of wing, etc., are different in the two species.

As no species of *Pemphigus* is recorded from *Cynodon* (*vide* Patch, *Host Index of World's Aphidae*, 1913) I have provisionally named it *Pemphigus cynodonti*.

The generic position has been discussed above in connection with *Pemphigus aedificator*.

Genus **MACROSIPHUM** (Pass.).

(= *Siphonophora*, Koch).

This genus, and as a matter of fact the entire family, has its home in temperate regions where it is numerically best developed. In the tropical and subtropical plains of India it is rather sparsely represented although the Himalayas harbour a very large number.

Leaving out of account the hill forms a short identification table for the few species from the plains is given below:—

A. Colour (including body) green.			B. Colour red brown or chestnut.		
I. Cornicles green.		II. Cornicles black.	(i) Body surface dull. Cornicles very long, twice the length of cauda. Hosts <i>Sonchus</i> spp.	(ii) Body very shining. Cornicles short and conical, subequal with cauda. Hosts Garden Chrysanthemums.	
Cornicles somewhat curved.	(i) Apterous female ovate or oval: short and conical.	(ii) Apterous female long oval, almost linear. Cornicles long and cylindrical. Hosts <i>Rosa</i> spp.			
Antennae black at joints	Hosts Graminous plants.				
Hosts mostly Leguminous plants.					
(1) <i>Macros. pisi</i> (Kalt.)	(2) <i>Macros. granarium</i> (Kirby).	(3) <i>Macros. roseiformis</i> , n. sp.	(4) <i>Macros. solidaginis</i> , Fabr.	(5) <i>Macros. sanborni</i> (Gillette).	

With the possible exception of No. 4 (see below) all of them are pests of economic importance; short accounts of them have been prepared separately in the following pages.

Macrosiphum pisi (Kalt.).

“Green dolphin” (English).

“Green Pea Louse” (American).

Syn.—*Siphonophora pisi* (Koch. Buck.).

Nectarophora destructor (Johnston).

Plenty of literature exists on this notorious insect. Several papers by Messrs. Johnston, Sanderson and Chittenden have appeared on the control and remedial measures against this destructive pest of peas in America (*Circulars and Bulletins of U.S. Dept. of Agr.*, 1908-1909).

Gillette has figured the antennae and cornicles in the *Jour. Econ. Entom.*, vol. IV, p. 384; 1911.

Theobald gives figures, description and a fairly complete bibliography with a list of synonyms (*Jour. Econ. Biol.*, Sept. 1913, p. 134).

Mr. J J Davis, of the Bureau of Entomology, U.S.A., states that he is about to publish a complete account of the morphology and natural history, etc. of this insect.

I find that the Indian insect is identical in all respects with the European and the American form, and as the descriptions of these are easily accessible no further morphological account is needed here.

Life-history.—This insect would often be attracted by white clothes and settles on them if on the wing. Its ravages to pea crops have been said to be very serious in the United States of America, but so far I have not noticed it here in any large numbers upon them. Possibly it is controlled and kept in check by natural enemies, but there is no doubt that it is a standing menace and might become a bad pest in any year favourable for its reproduction. So far it has been sparingly infesting the following plants in Lahore and some of them are those not recorded as its hosts in other countries:—

- | | |
|--|----------------------|
| (1) <i>Alhagi maurorum</i> | 22nd February, 1913. |
| (2) <i>Melilotus alba</i> | April, 1913. |
| (3) <i>Medicago sativa</i> (Lucerne) | 27th March, 1913. |
| (4) <i>Medicago falcatum</i> (Vern. Methe) | 13th April, 1913. |
| (5) <i>Clianthus dampieri</i> (Glory flower
or Parrot beak) | 12th April, 1913. |
| (6) <i>Lathyrus adoratum</i> (Sweet Peas) | February and March. |
| (7) <i>Dolichos lablab</i> (Sem) | 28th August, 1913. |
| (8) <i>Peganum harmala</i> | 3rd March, 1913. |

Natural enemies.—Besides the usual enemies, this species is liable to the attacks of the fungus "Entomophthora aphidi" which destroys it in large numbers. Mr. G. R. Dutt of the Research Institute at Pusa once sent me specimens from sweet peas where the fungus had done particularly good work in reducing it. The infected insect first swells up a little, then getting stupefied fixes itself to one side of the twig or leaf not favourable for feeding, turns yellow and later on shrivels up to a scaly form.

Another *Macrosiphum* sp. is occasionally collected on sweet peas in May. It is about the same size as *Mac. pisi* and resembles it closely in colour, etc. Further, it has cornicles which are smooth throughout without any area occupied by polygonal markings. But its cornicles are much smaller, conical and hardly reaching to the base of the cauda. The description of this form is omitted in this paper.

***Macrosiphum rosaeiformis*, n. sp.**

"THE PUNJAB ROSE APHIS."

Hosts.—Several species of cultivated roses in gardens (*Rosa centifolia*, *R. damas-caus*, *R. moschata* and varieties.)

Distinguishing characters.—A large green aphid with brilliant red eyes, clustering head downwards, in lines, over the tender shoots or flowerbuds. The size of the shoot often appears twice as thick as it actually is, because of their overcrowding

numbers. Body elongated, cornicles black; large yellowish-green cauda and long black antennae on frontal tubercles; the pattern on the back of the alate female, as shown in the figure, and about sixteen sensoria on the third antennal article are distinctive.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Form of the body much elongated oval or elliptical, from three to four times longer than broad; the body has short rows of hairs on well marked segments; without any mealy covering.

Colour yellowish-green, dark green in places; appears mottled because of the red eyes of the young embryos seen through the skin.

Head and post-cornicular part yellowish.

No pattern except the two rows of brown depressions in line with the lateral grooves and running internal to the cornicles. The segment immediately behind the cornicles is oily and elevated above the general surface.

Head yellowish, almost as broad as long, distinct but not large; frontal tubercles about half the size of the first antennal joint, front rather shallow with a median convexity and a few short hairs.

Eyes large and red, with well developed ocular tubercles.

Antennae either wholly black, except for the lighter basal two joints, or light greenish ringed with black at the articulations; distal third always black; hairs short and sparse, arising from small tubercles. Length about that of body or slightly longer, not reaching beyond the body.

Length proportions:—

	III.	IV.	V.	VI.
	49	35	30	8+41
Lengths ..	0.79	0.57	0.50	0.13+0.70 mm.

The third article bears only two or three sensoria.

The prothorax bears a small lateral tubercle, which is rather unique as we do not find them in this genus.

Cornicles black, conical, long and projecting backwards and outwards, slightly curving also; bases swollen and light in colour; the proximal four-fifths granulated finely, the distal one-fifth narrowed, always darker and bearing polygonal markings over its surface.

Cauda light yellowish, thick, constricted near its basal third part and afterwards gradually narrowing; sharp tooth-like tubercles and curved hairs are present as usual. In life the cauda is carried like a sabre with a gentle curve; it is about half the length of the cornicles.

Anal and genital plates distinct; the latter concave anteriorly.

Legs long and light greenish; a little dusiness at the knees, while the tarsi are black.

Rostrum short, yellowish; last two joints subequal, reaching to the level of second coxae.

Measurements :—

Body	..	..	..	2.6—3.0 × 0.95 mm.
Antennae	..	..	..	3.1 mm.
Cornicle	..	..	..	1.1 ,,
Cauda	..	..	..	0.55 ,,

Alate viviparous female.—Body long oval, with a very slight bloom on the undersurface of the thorax.

The colour of the head and thorax appears dusky ochraceous yellow; abdomen a darker green than the apterous female; antennae, legs and cornicles much blacker.

The pattern on the abdomen consists of three large circular spots on the carina of the pre-cornicular portion. One small spot on the first abdominal and another faint one just outside the cornicles; a row of large transversely flattened spots in the lateral grooves. At least two round spots in front and in line with the cornicles; about two transverse stripes on the mid-dorsum of the first two abdominal segments. There is no spot around the bases of the cornicles or on the hinder segments which are said to be present in true *Macrosiphum rosae*.

Head dusky or black, concolorous, with small frontal tubercles; front rather shallow, not deeply channelled as in other species.

Eyes red; with stemmata and the usual three ocelli.

Antennae wholly black, longer than body.

Length proportions exactly the same as in apterous females.

	II.	IV.	V.	VI.
Lengths ..	0.80	0.57	0.48	0.11 + 0.81 mm.

Sensoria (secondary) on article III from 14 to 16, placed ventrally almost in one line; all of them circular and having a double contour.

The prothorax bears a broad dusky band on its anterior margin and a distinct lateral tubercle on either side; concolorous with mesothorax.

Mesothorax ochraceous yellow in colour; on its dorsum four black muscle-bosses and prominent stigmal spots on lateral sides; meso-sternal bosses also occupy a small area on the ventral side, while on their sides, a little laterally placed, are two conspicuous but small dots.

The metathorax has a transverse band in front of which is to be seen another semilunar mark.

The wings are large with normal venation; occasionally the second furcal is wanting.

Stigmal flattening dark brown; a camera lucida drawing shows the arrangement of the veins.

Cornicles quite black, similar to the apterous female, only smaller in size.

Cauda long, with a slight constriction above the broad basal third part; it is about half the length of the cornicles.

The legs are much blacker, specially the distal femora and tarsi, which are of the same colour as the cornicles; tibiae dusky, coxae of body colour.

The ventral surface is lighter in colour.

The rostrum reaches up to the second coxae.

Measurements :—

Body ..	..	..	..	2.50 × 0.85 mm.
Antennae ..	..	..	..	3.00 mm.
Cornicle ..	..	..	..	0.70 ,,
Cauda ..	..	..	..	0.39 ,,
Wing expanse ..	..	..	..	8.50 ,,
Wing ..	..	..	..	4.0 × 1.45 mm.

The "Punjab Rose Aphis" has a very strong superficial resemblance to the famous "Rose Aphis," *Macrosiphum rosae*, Linn., said to be very common and often destructive in orchards and gardens in Europe and America. Apparently the same insect is met with in the East as well, as I have received specimens from Mr. van der Goot, who collected them on rose bushes in Java. They are in no way different to the insects I received from Europe and America.

Lefroy mentions *Macrosiphum rosae* (Linn. or Reaum.) as occurring in India (*Indian Insect Life*, p. 747). I believe that this is based on Buckton's identification, who had received some specimens from the North-Western Provinces and who considered them as identical with the English Rose Aphid, vide *Monog. Brit. Aphid.*, Vol. IV, p. 181.

I do not find Buckton's identifications very reliable so far as Indian plant-lice are concerned. In several instances in the case of insects sent him from the Indian Museum, Calcutta, even the genera are incorrect. About the species under review I can only say this much, that it is quite likely that India may be the habitat of true *Macrosiphum rosae*, Linn., but so far it has never been collected by me on rose bushes in the Indian plains. As there is a chance of this species being easily mistaken for the European Rose Aphis, I tabulate below the chief morphological characters in which the two insects differ from each other.

I am calling this species *Macrosiphum rosaeiformis*, n. sp., as there does not appear to me any other species of this genus to which it would be so nearly related as *M. rosae*, Linn., from the literature available.

DIFFERENCES IN THE TWO FORMS.

Macrosiphum rosae (Linn. or Reaum.).

Macrosiphum rosaeiformis, sp. nov.

Apterous viviparous female.

Apterous viviparous female.

(1) Body about twice as long as broad.

(1) Body much longer, sometimes over three times longer.

(2) Sensoria on 3rd antennal article from 8 to 10 (Essig); from 3—5 large and 3—5 small (Theobald).

(2) Sensoria never more than three, often only two.

Alate viviparous female.

- (1) Body broader.
- (2) Antennae 3.55 mm. to 4.2 mm.
- (3) Sensoria very many (Essig); from 42—48 (Theobald); over entire length.
- (4) Pattern on abdomen: three spots on sides; a black patch at bases of cornicles; a crescentic one in front and two dark patches behind on either side; last segments with a black stripe.

Alate viviparous female.

- (1) Body narrower.
- (2) Antennae 3.0 mm., quite similar to that of the apterous female.
- (3) Sensoria on 3rd article never more than 16; from 14—16 ventral and in one line.
- (4) Pattern on abdomen: three lateral spots large and two smaller; patches at bases in front and behind absent; also the dark band on the last segment.

Two rows of spots in last grooves; two spots in front of and in line with cornicles; transverse marks on the middle of first two abdominal segments present.

There are also some other minor discrepancies which can be explained as individual variations, but in view of the above account it forms a very good species.

Twice a year roses in Lahore produce new shoots, once in March and again about October or November. At both these periods the "Rose Aphis" can be collected. My dates from the City Circular Gardens and the Botanical Garden have been early December and March-April. As there are always a few young shoots present throughout the winter it is true that the species remains actively viviparous during this period, but after April or early May no trace of it is to be found in the plains. Whether it migrates or deposits eggs after producing sexual forms on the approach of summer is still undetermined.

Natural enemies :-

- (1) *Lysiphlebus* sp. which extensively parasitises it.
- (2) Syrphids, several species.
- (3) Coccinellids, chiefly *Chilomeles sexmaculata*, often clearing twig after twig.

Unlike the European Rose Aphis there is no pink variety in the case of this insect.

Macrosiphum granarium (Kirby; Pergande).

"WHEAT GRAIN-LOUSE."

Literature :—

Buckton, *Brit. Aph.*, vol. I, p. 114.

Pergande, *U.S. Dept. of Agric. Div. Ent. Bull.* 44, 1904.

Theobald, *Jour. Econ. Biol.*, vol. VIII, 1913 (gives description and figures; a part of the accompanying illustration is copied from Theobald's figure).

The large wheat plant-louse is easily recognisable in the field from the brief diagnostic characters already given above (p. 157). It infests several graminous crops grown in winter, more especially wheat, barley and avena.

M. granarium can be collected from wheat or avena blades as early as November, when the avena or wheat seedlings are hardly a few inches high. It continues throughout the winter, till the wheat is removed from the fields in early April.

At this time it clusters round a common graminous weed, a species of *Agrostis*; even parasitised females flock to this grass, but what occurs to them later has not been followed out.

Parasitisation of this species is very extensive.

Macrosiphum sanborni (Gillette).

Host.—Cultivated Chrysanthemums.

Literature :—

Sanborn, *Kans. Univ. Sc. Bull.*, vol. III, 1 (under *Siphonophora chrysanthemi*).

Gillette, *Can. Entom.*, vol. L, 2, p. 65, 1908.

„ *Jour. Econ. Entom.*, vol. IV, p. 385, 1911 (antennae and cornicles figured).

This Aphid as found in the Punjab is identical with the American species, only our early winter specimens are larger.

Biology and life-history.—This species first appears on Chrysanthemums in late September or early October. It appears certain that these are the “stem-mothers” hatched from eggs, laid at some previous time upon these plants. They are very large and are all apterous. One or more isolated specimens may be found on each plant with a small brood of a few young that are vermilion red. Soon after this the numbers increase and after the second generation alate females develop which spread the species. This process continues till December.

The shining red-brown insects cluster on the tops of young shoots and only when very numerous attack the veins of the leaves as shown in the plate.

They sit in rows upon the angles of the twigs with their heads directed downwards. The slender beak can be readily withdrawn and the insects drop to the ground even at the suspicion of alarm.

They have a curious habit of swinging or jerking their bodies from side to side with the long hind legs dangling in the air. This is done almost rhythmically; all the members of the colony take part in it and keep time with a regular swing; all the time the beaks remain inserted. This habit probably keeps them safe from parasites.

The species becomes scarce in December when the sap in the plants is diminished after the flowering period is over. The few survivors are stunted in size.

In January again a few shoots begin to sprout, but are abundant only in February and March. In the latter months the insects are again active on the new leafy branches. After April they entirely disappear leaving no visible trace behind.

A few attempts were made to secure the sexuales but were unsuccessful.

Its enemies are chiefly *Chilomeles sexmaculata*, the young of a Mantid and small species of Syrphids.

Systematic.—In the structure of its cornicles and cauda it differs materially from typical species of the genus *Macrosiphum*. The following points may be specially noted :—

- (1) The cornicles are unusually small and stout; reticulation extends over more than two-thirds of its distal surface, while in other species it occupies only a small apical portion.
- (2) The cauda is very large and thick, irregularly cylindrical, with a rounded tip, not sabre-like and pointed.
- (3) The cauda is longer than the cornicles, while in typical species it is considerably smaller.

It would perhaps be appropriate to separate it into a different genus or subgenus.

A *Macrosiphoniella* has been described from chrysanthemums by Del Guercio recently in the Italian Journal "*Redia*," with which at present I am unacquainted. It may be this species.¹

Macrosiphum solidaginis, Fabr.²

Hosts.—*Sonchus oleracea*, *Sonchus arvensis*, *Sonchus* sp.

Biology.—This insect is of no economic interest as it infests only the wild species of *Sonchus*. The earliest date of its appearance in Lahore is the first week of January; it soon thickly covers over the stalks of inflorescence and later attacks the leaves. About this time it is usually destroyed wholesale by the Fungus *Entomophthora* sp.; from January onwards up to May it is found on its host only occasionally.

A few observations were conducted on some colonies kept in the laboratory, relative to the effect upon them of the diurnal heat. As the maximum temperature for each day began rising and reached about 95° F. in third week of March all the insects deserted the plant. After two weeks or so there was a shower of rain and during two cloudy days that followed several apterous females were seen on the same plant. In the middle of April when the maximum reached 104° F. again not a single insect was to be observed above-ground; early in the last week, however, another slight rainfall with threatening weather brought out the Aphid on the same plants. They seemed to come up after every slight rainfall.

These observations were not carried forward into the season, neither was the further life-history followed as to what time the sexuales, etc. are produced.

The three species of *Sonchus* are the only hosts known at present in Lahore, though in Java many other species of Compositae are said to be its food-plant.

Systematic.—The "Eastern *Sonchus* Aphid" is quite different from the insect familiarly known by the same name in the West, *i.e.* *Macrosiphum souchi*, Linn.

¹ [*Macrosiphum sanborni*, Gill. very clearly belongs to the genus *Macrosiphoniella*, Del Guercio, which genus seems to differ principally from *Macrosiphum*, Pass. in having the cornicles shorter than the cauda. This same chrysanthemum-aphid has been described by Mr. Theobald as *Macrosiphoniella bedfordi*, Theob. (*Bull. Ent. Research*, vol. IV, 1914, p. 318), a name later on corrected by this author to *Macr. chrysanthemi*, Del. Guercio (*Bull. Ent. Res.*, V, 1915, p. 112), which again must fall as a synonym to *Macr. sanborni*, Gill., the latter name being of an earlier date (1908). P. v. d. G.]

² [Literature on *Macr. solidaginis*, Fabr. :—

a. Kaltenbach, *Die Pflanzenläuse*, 1843, p. 32.

b. Koch, *Die Pflanzenläuse*, 1857, p. 197.

c. v. d. Goot, *Beitr. z. Kenntniss der holländischen Blattläuse*, 1915, p. 90. P. v. d. G.]

The latter is listed by Lefroy in *Ind. Insect Life*, p. 747, from safflower (*Carthamus tinctorius*), but I have never collected it from anywhere in India nor have I so far seen any Indian specimens of the same.

M. sonchi is easily recognised by the tufts of hair on the abdominal segments besides other structural features. The colour and food-plant, however, being the same, confusion between the two is quite likely to occur.

I have not been able to compare *M. solidaginis* with the American insect *Macrosiphum sonchella* (Monell), but in correspondence with Mr. P. van der Goot I have learnt that the Indian *Sonchus* Aphid is identical with the Javanese one, which he considers to be identical with the European *Macr. solidaginis*, Fabr. I have therefore accepted the name as given by van der Goot.

Rhopalosiphum lactucae (Kalt.).

Syn.—*Aphis lactucae* (Kaltenbach).

Rhopal. ribis (Koch), according to Buckton.

Literature :—

- (1) Kaltenbach, *Mon. d. Pflazenlause*, 1843.
- (2) Buckton, *Mon. Brit. Aphid.*, II, pp. 9, 10.
- (3) *Jour. Econ. Entom.*, III, p. 378.
- (4) Sanderson, *Canad. Ent.*, XXXIII, p. 70 (1901).
- (5) Theobald, *Journ. Econ. Biol.*, III, 3, p. 105 (1912).
- (6) Schouteden, *Aphids de Belg.*, p. 236 (1906).

Food-plants.—In Europe and America this insect has been recorded on the following plants:—

- (1) *Sonchus oleraceus*.
- (2) *S. asper*.
- (3) *S. arvensis*.
- (4) *Cichorium endiva*.
- (5) *Ribes rubrum* }
- (6) *R. grossularia* } Currants and Gooseberries.
- (7) *Lapsana vulgaris*.
- (8) *Picris heiracoides*.

In the neighbourhood of Lahore it has been observed rather sparingly only on the three species of *Sonchus* mentioned above; especially on *S. asper* growing in shady places or along the edges of water-courses in Gol-bagh and the Ravi forests.

The time of appearance is always from May to June, clustering round young flowerheads.

Distinguishing marks.—A rather large Aphid, from yellowish-green to green in colour; long greenish antennae, legs and cauda; cornicles very much swollen in their distal halves; alate females with a black irregular blotch and smaller spots on the back; the apterous females are provided with a few sensoria on article III of the antennae; it appears in May on *Sonchus* spp.

The species can easily be identified from the above diagnosis, and as fairly accu-

rate descriptions are available in the literature cited above no further characterisation is given here. My figures sufficiently indicate the morphological characters.

Systematic.—The genus *Rhopalosiphum*, Koch, has several characters in common with *Macrosiphum*, but is distinguished at once by the clavate cornicles. According to the latest definition *Rhopalosiphum* ought to have a few secondary sensoria on the 3rd antennal article of the apterous viviparous female. The cauda is said to be about $\frac{1}{2}$ — $\frac{1}{3}$ the length of the cornicle. The Punjab species differs somewhat in having a longer cauda. Moreover, in an otherwise excellent description with plates by Theobald (*Jour. Econ. Biology*, III, 3, 1912) no sensoria are shown on the apterous antennae of *R. lactucae* on *Ribis* sp., while their number on article IV of the antennae of the alate female is from 17-20; in the Lahore specimens I have never found them to be more than from 10-13. Measurements are not given by Theobald but the Lahore specimens agree fairly well with those of Buckton although the latter mentions the apterous female antennae as smaller than the body but figures it longer, which, as a matter of fact, it is.

In spite of these minor apparent differences I believe that the Indian insect is identical with the European and the American form.

So far it has not been observed to infest any plant of economic value, as it does gooseberries in the West; nor is anything known of its further life-history after its disappearance in June. Its appearance also in the beginning of May is equally sudden, and it has been met with at no other time of the year. Of course there is no record of its existence in India before this.

***Myzus persicae* (Sulz.)**

Syn.—*Rhopalosiphum dianthi* (Schr.)

Synonyms and Literature.—There is plenty of literature current both in Europe and America concerning this notorious and cosmopolitan plant-louse. It has either been described as *Rhopalosiphum dianthi* or as *Myzus persicae*, although these are by no means its only synonyms. Some of them, along with an accurate colour description, will be found in Buckton's *Monog. Brit. Aphides*, II, p. 15. But perhaps the latest with an excellent account of its morphology and life-history, as well as some of the more important literature, will be found in two papers, one by Prof. Gillette in the *Jour. Econ. Ent.*, vol. I, p. 359, 1908, and another in the same volume on page 83 by Taylor. The latter author has discussed and conducted some remedial measures also. A very useful summary of their work is given conjointly with fine illustrations in Bulletin Nos. 133 and 134, Colorado Exp. Station, 1908.

Indian references.—Indian notices of this Aphid may be seen in *Ind. Mus. Notes*, vol. IV, no. 1, p. 23, 1896, where the description is copied from Buckton, and vol. IV, no. 4, p. 197, 1899, which contains a list of European host-plants as given by Walker. An indifferent plate accompanies the former reference, which is evidently a poor reproduction of Buckton's. The same has been figured by Lefroy in *Ind. Ins. Life*, p. 744, 1909.

It has been reported from Calcutta on rape and brinjal (*Solanum melongena*).

The actual specimens in the Indian Museum labelled as *Rhop. dianthi*, upon Brinjal, that I had occasion to examine, proved mostly to be *Aphis malvae*, Koch; so the latter reference in the *Ind. Mus. Notes* is probably an error.

The Aphid may be found almost at any time wherever there is any kind of *Brassica* crop growing and then mostly in company with *Siphocoryne indo-brassicae*, n. sp. But its hosts are numerous and I have given below a list of plants on which it has been actually collected.

The life-history appears to be much the same as in America, but details have not been properly followed out yet.

This species is extremely abundant after August and September. Numerous plants serve as hosts as will be seen from the list. During October and November *Brassica* crops are their special favourites and they feed on these usually in company with *Siphocoryne indo-brassicae*. About the last week of November, from various herbaceous plants, large autumn migrants and alate males begin returning to young peaches and settle on the under side of the leaves. Throughout December this continues. The colonies from whence they come themselves retain their parthenogenetic reproduction as usual, and there is hardly any perceptible diminution in numbers by their migration.

The "return migrants" are much larger and give birth to young which develop into deep pink.

Oviparous females.—Egg-laying does not start before January, unlike what obtains in the west, where it is reported to commence as early as the first week of November.

Winter is in no way detrimental to their life and viviparous females remain fairly active after sunrise even on the coldest days. They pass into spring in this manner; when food is more abundant the colonies multiply quickly.

As is the case with many other plant-lice in Lahore, this species also disappears about the beginning of May, and the earliest date for collecting it again is the last week of August as apterous viviparous females on cruciferous plants.

It may be that some eggs hatch at this time, but then they do not hatch upon the peach.

The ordinary predaceous and parasitic insects feed upon them.

Systematic.—According to the investigations of Gillette and Cholodkovsky, the correct name for this species is *Myzus persicae* (Sulzer). It has been frequently referred to as *Rhopalosiphum dianthi* (Koch) in the literature on these insects.

The explanation offered by Gillette for the mistake about the genus is that the "spring migrants" in this case possess cylindrical cornicles, while the "autumn migrants" have them clearly clavate in their distal halves.

In Lahore so far we have not secured any specimens with straight cornicles, they are always more or less swollen.

Recently the species has been separated into a new genus (*Myzoides*) by van der Goot, 1913, along with two more similar Aphids. As this name has not been generally accepted yet I have retained the old one of *Myzus persicae* (Sulzer).

Food-plants.—*Myzus persicae* (Sulz.) [= *Rhopalosiphum dianthi* (Schrank)] has

been notorious for its extremely polyphagous habit. Its distribution also is more or less cosmopolitan and one often finds lists of food-plants on which it is usually seen feeding published separately for each country. I give below a list of hosts from which the insect has been collected by myself in Lahore and the neighbourhood. The most favourable hosts and those upon which it may be observed feeding almost any day throughout the winter, in company with *Siphocoryne indo-brassicae*, are the plants belonging to the Natural Order Cruciferae and more particularly to the various species and sub-species of the Genus *Brassica*. But it can live and reproduce on almost any green and succulent plant. The list includes several plants which this insect has not been reported to infest in other countries; and, though a fairly large one, does not pretend to be at all exhaustive.

- (1) *Althea rosea* (Vern. Khatmi).
- (2) *Ageretum conyzoides*. In March.
- (3) *Brassica juncea*. Rape and Mustard (Vern. Sarson). November to March.
- (4) *Brassica oleracea*. Cabbages and Cauliflowers (Vern. band-, gand- and phulgobhi).
- (5) *B. campestris*.
- (6) *B. rapa*. Turnip.
- (7) *Erruca sativa*.
- (8) *Raphanus sativa*.
- (9) *Sisymbrium iro*.
- (10) *Capsella bursa pastoris*.
- (11) *Coronopus dydimus*.
- (12) *Convolvulus major*. January-February.
- (13) *Ipomea guttata*.
 ,, *I. crispa*.
 ,, *I. mexicana*.
 } Morning and Evening Glory.
- (14) *Withania somniferum*.
- (15) *Nicotiana tobaccum*.
- (16) *Datura stramonium*. (The pupae here are often pink coloured).
- (17) *Linaria*, several species. Toad-flax. February-March.
- (18) *Antirrhinum* sp. Snapdragon.
- (19) *Euphorbia helioscopiae*.
- (20) *Mazus* sp. River side in April.
- (21) *Malva sylvestris*.
- (22) *Prunus persicae*. (Often pinkish in colour, in company with *Aphis pruni*, after March).
- (23) *Dianthus caryophyllus*.
- (24) *Pyrus communis*.
- (25) *Dalbergia sissu*.
- (26) *Solanum tuberosum*.
- (27) *S. lycopersicum*.
- (28) *Stellaria media*. In February.

- (29) *Rumex dentata*.
- (30) *Chenopodium* sp.
- (31) *Tropaeolum* sp. Nasturtium.
- (32) *Viola tricolor*.
- (33) *Gallium* sp.
- (34) *Cinaria*.
- (35) *Echinops echinata*.

Phorodon cannabis, Pass.

(Bhang Aphid. Vern. Bhang Tela).

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body rather long elliptic, tapering towards ends; more than twice as long as broad, provided with distinct knobbed hairs mostly directed backwards.

Prevailing colour deep green; sometimes very light coloured individuals are met with, especially in March and April. Three broad longitudinal stripes run down the back from the head to the apex of the abdomen. The lateral stripes have dark spots to indicate the abdominal segments, well seen in fixed specimens. The thoracic segments are marked off by green transverse grooves.

Head green; front very narrow with a few capitate hairs; frontal tubercles large and each produced into a well-marked tooth directed forwards and inwards, carrying a few hairs.

Antennae above the tubercles green proximally, while the distal half is black; the whole surface furnished with scattered and similarly knobbed hairs.

The first joint is drawn forward into a tooth on the inner side, with hairs on its end.

Antennae slightly shorter than the body.

Length proportions of the joints from the third segment onward as follows:—

	III.	IV.	V.	VI.
	20	14	12	5 + 21
Lengths	·33	·23	·2	·08 + ·42 mm.

Prothorax green like the rest of the thoracic segments, the lateral depressions being well marked as usual. The sides are well rounded; there is just the appearance of a short tubercle near the posterior edge.

The skin on the abdomen is marked off into very irregular areas whose boundaries rise clearly above the general surface. It gives a strange corrugated but a distinctive appearance to the species under the microscope.

Cornicles long, thin, cylindrical, occasionally slightly clavate; green throughout in young and smaller individuals, but smoky on the distal quarter in the adult and old specimens. They lie in a sickle-like curved manner (see figure), at first directed backwards and towards the middle line, then slightly diverging. They project beyond the cauda and often are full of oil globules, forming a row within the cornicle.

Cauda green, long conical, with sharp tubercles and a few strong hairs.

Legs green with knobbed hairs; only the tarsi are black with short first segment.

The rostrum just reaches up to about the middle of the second and third coxae. Colour greenish with a smoky tip.

Measurements of large specimens on an average are:—

Body ..	..	..	..	1.70 × .75 mm.
Antennae	..	..	..	1.5 mm.
Cornicle	..	..	..	.66 to .75 mm.
Cauda	..	..	..	0.166 mm.

Alate viviparous female.—Body long oval; prevailing colour green or slightly yellowish-green; devoid of hairs.

Head black, triangular, with a narrow front carrying the median ocellus in the centre.

Frontal tubercles distinct, strongly porrected (as in the apterous female) into a pointed tooth without capitate hairs.

Antennae black, about equal to the body length; a long spur to the sixth joint, third joint strongly tuberculate.

Sensoria, 16–19 on III; 5–7 on IV. The primary sensoria on V and VI have a strong “hair-rim.”

Length proportions:—

	III.	IV.	V.	VI.
	24	16	15	6 + 29
Lengths ..	.40	.26	.25	.10 + .49 mm.

The prothorax is sharp-edged and broad posteriorly and has a black band near the front margin, two black dorsal dots on the sides and a green transverse stripe behind.

Mesothorax large, yellowish, with four shining black muscle-lobes on the top; on the sides a large stigmal spot, black in colour.

The metathorax is narrow and has two lateral spots and a crescentic band near the posterior edge.

Abdomen ovate with a wavy margin; the colour is green; darker green central and two lateral stripes are indistinctly apparent.

The pattern of black dots and stripes, as shown in the figure, is made up of:—

- (i) Three large black spots on the carina.
- (ii) Four (plus an indistinct fifth) broad black stripes on the posterior half of the abdomen. The one just in front of the cornicles is crescentic.
- (iii) A double row of fairly large spots on the lateral grooves, of which the first three segments have both the spots confluent with each other, making the spot appear a very broad one. The fourth segment has them separated, one spot just in front of the cornicles and almost in line with the three larger carinal ones, the other touching the second broad ab-

dominal band. On the fifth the inner spot just meets the third band, while the outer one just lies behind the cornicles. The segment behind has only two lateral spots.

Wings large and broad; slightly smoky in appearance; slightly dusky flattenings at apices. Veins very dark; cubitus with a double fork and obsolete at base. Stigma dark brown at the flattening with yellow insertions; the stigma has a gentle curve as shown in the camera lucida drawing.

Cornicles black, long and cylindrical, with a distinct rim reaching to the tip of the extended cauda.

Cauda long, with one or two indentations; dusky green.

Anal plate semicircular. Genital plate brownish and made up of two darkish halves.

Ventral surface segmented and of a light greenish or yellow colour.

Legs like the apterous female, slightly more dusky, without knobbed hairs:

The rostrum just reaches the second coxae beyond the black sternal muscle-bosses.

The lateral tubercles are absent.

Measurements :—

Body	1.60 × .65 mm.
Antennae	1.60 mm.
Wing expanse	5.80 ,,
Wing ..	2.6 × 1.1 mm.
Cornicle	0.45 mm.
Cauda	0.166 ,,

Life-history.—The species makes its appearance in October on old sickly-looking plants of *Cannabis*. The specimens from which the description has been prepared were collected in November near the bridge on the Ravi adjoining reserved forests. They multiply freely till some time in December when sexuales are produced. Only on one occasion, below a mango grove along the opposite bank of the Chhota Ravi, a few young oviparous females were secured. They resembled the apterous viviparous female, except that the colour was pink and the hind tibiae stout and swollen on account of the presence of many small circular sensoria.

No males were captured; probably they are alate and form a little earlier. Neither was it possible to collect the eggs.

In the absence of any definite data, which further observations might furnish, it can only be surmised that alate males and some migratory females fly off to some other host where, after the oviparous females have developed, the eggs are deposited to tide over the winter.

Such an alternate host is probably one or more compositous plants, besides *Cannabis* itself, on which the winter may be passed even in the parthenogenetic condition.

In March and April the species is sparingly present on *Cannabis indica*, in the angles between the ventral veins of the leaves. But it thickly infests the under sides of the leaves of *Cnicus arvensis*. It may be collected on the latter throughout May,

but in June this plant is entirely deserted and the Aphid either dies or migrates to some unknown place.

In this connection it is interesting to note that I have collected the identical species in Simla and the neighbouring hills in July and August. The hosts there are *Cannabis indica*, *Cnicus* sp. (a long-leaved and very spiny kind) and *Artemesia* sp.

The life-cycle would, therefore, be completed somewhat as follows :—

In March and April the eggs laid in the previous winter (December) hatch into stem-mothers, on some compositous weed and possibly also on *Cannabis*. They give birth to spring generations that stay in the plains up to about June. They are in evidence again during October and November. The hot summer months are in all likelihood passed in some cool shady places out of sight, or in the hills.

Late spring individuals on *Cannabis* are smaller in size than the autumn ones.

An *Aphidius* and a *Lysiphlebus* extensively parasitise this Aphid changing it into shining inflated skins with a circular hole on one side. The parasites are most abundant in April, issuing in large numbers from the bodies of wheat Aphids.

The insect is apparently of no economic importance, unlike the famous Hop-louse, *Phorodon humuli*, of Europe and America.

Systematic.—The *Cannabis* Aphid is a near relation to the famous Hop-louse of Europe and America and is in some respects very similar to it, infesting a plant of the same order. But Hops (*Humulus lupulus*) are never grown here nor has *Phorodon humuli*, its pest, been so far observed in India.

The generic characters of *Phorodon*, Pass. (lit.=tooth carrier), as given by Passerini, *loc. cit.* and quoted below, are quite apparent.

Antennae tuberculo frontali suffultae, articulo primo intus dente valido adaucto. Frons inter antennis plana; nectaria longissima, cylindrica vel leviter clavata; caeterum ut *Siphonophora* (*Macrosiphum*).

The latest and emended characters given for this genus (van der Goot, *Zur Systematik der Aphiden*, 1913) are chiefly as set down by Passerini with additions, etc. as follows :—

Body almost hairless or with extremely short hairs, not scattered in groups or knobbed.

Lateral tubercles absent.

Antennae not longer than body, in the apterous female distinctly shorter; first segment with a strong tooth on the inner side. Frontal tubercles well developed, having a similar tooth but more marked. The absence of sensoria on the third antennal article distinguishes it further from the genus *Macrosiphum*, which it resembles in other respects.

The Indian species is rather peculiar in having capitate hairs scattered all over the body in rows, mostly directed backwards. The antennae and the characteristic teeth also carry a number of similar hairs. A slight clavation of the cornicles is also observable in the large apterous female. The pattern on the skin, *i.e.* the peculiar corrugations described above, seems to be absent in all the species described so far. Both the capitate hairs and the skin-pattern are absent in the alate female. The

presence of capitate hairs is rather a deviation from the generic characters, but they are confined to the apterous forms only.

Passerini has described a species of *Phorodon* on *Cannabis*, but the accounts of these insects by older writers was confined chiefly to the superficial characters which are often not very reliable. As even these earlier accounts are not available in English, I have prepared the description of the insect as found in the Punjab.

It is likely that the Italian and the Indian insects are identical, so I have adopted Passerini's name for the present instead of proposing a new one.

CLUB-CORNICLED APHIDS.

A short notice of the history of the genera *Rhopalosiphum* (Koch) and *Siphocoryne* (Pass.) might well precede the accounts to be given in the following pages of some Indian Aphids that are related to them in a way, though differing in several important respects.

The genus *Rhopalosiphum* of Koch was first split up by Passerini into two groups. One set of species had antennae placed directly on the head, and the other carried them on frontal tubercles. Koch's name was retained for the latter, while *Siphocoryne* (Pass.) was proposed for the former (*Aphidae Italicae*, 1863). "Rhopalos" and "Coryne" both mean a "club" and refer to the swollen or clavate character of the cornicles or "siphunculi."

The indistinct presence or absence of frontal tubercles is often confused, and it becomes a matter of individual opinion whether a particular species should be put in one or the other genus.

Monell suggested an amalgamation of the two genera which was not accepted, and Lichtenstein (1885) who followed Passerini defined the genus *Siphocoryne* thus:—

- (1) Antennae implanted directly on head, non-hairy, with seventh joint distinctly longer than sixth.
- (2) Nectaries long and clubbed.

Buckton (*Brit. Aphid.* 1887) held similar views and remarked that the genus partook the characters of *Aphis* and *Rhopalosiphum*. Oestlund (*Aphid. Minnesota*, 1887) further added that these characters were accompanied by the third antennal article being very "tuberculate" and the species attacking unbelliferous plants. This is not true for all species.

Van der Goot (*Zur Systematik der Aphiden*, 1913) has furnished a definition on morphological grounds and separates the two genera thus:—

Frontal tubercles well defined; a few sensoria on article III always present, in case even of the apterous female. *Rhopalosiphum*.

Frontal tubercles indistinct or absent; sensoria in case of the apterous female always absent. Cornicles clubbed in both. *Siphocoryne*.

Evidently here no notice is taken of the relative lengths of the antennae, body, cornicles and cauda, etc.

It is of interest that Walker very early pointed out and erected a new genus

Liosomaphis with *Rhop. berberidis* (Kalt.) as its type, and described it in the *Zoologist*, 1860, p. 1119. The distinctive characters were:—

- (1) Antennae shorter than body.
- (2) Seventh joint smaller than third.
- (3) Cornicles clavate on one side and about one quarter the body length.

The genus was never accorded any acceptance and Buckton brought back "*Lios. berberidis*" under *Rhopalosiphum*.

Wilson has attempted to revive it in his "Key to the genera of Aphidinae" (*Ann. Entom. Soc. America*, 1910), but apparently not with much success.

If we accept van der Goot's latest definition we should place *Lios. berberidis* under *Siphocoryne*, and after examining the insect I am of opinion that in spite of its very small frontal tubercles its natural affinities are with *Siphocoryne*. We may then for the present score off the genus *Liosomaphis*.

But *Siphocoryne* when thus defined forms quite a heterogeneous group including a large number of species. These have been proposed to be broken up into more natural subdivisions of generic importance by van der Goot and Theobald. The discovery of some new forms in the Punjab has necessitated the addition of two more genera. The whole view of the present situation can be summed up by giving the characters of the various genera proposed in tabular form.

APHIDINE GENERA WITH CLAVATE CORNICLES.

- I. Antennae of apterous female provided with secondary sensoria. *Rhopalosiphum*, Koch.
- II. Antennae of apterous female without sensoria (A).
 - (A). (i) Capitulate hairs over the body, cornicles clavate only on one side, frontal tubercles absent. *Stephensonia*, gen. nov.
 - (ii) Capitulate hairs absent; cornicles clavate on both sides; frontal tubercles indistinct or absent (B).
 - (B). (i) Cornicles smaller than or subequal to cauda. *Brevicoryne*, gen. nov.
 - (ii) Cornicles longer than cauda; frontal tubercles absent or inconspicuous (C).
 - (C). (i) A large precaudal tubercle present on the dorsum. *Tuberculaphis*, Theobald.
 - (ii) Large precaudal tubercle absent (D).
 - (D). (i) Lateral tubercles on first and seventh abdominal segment present. *Siphonaphis*, van der Goot.
 - (ii) Lateral tubercles on first and seventh segment wanting. *Siphocoryne*, Pass.

I am not quite sure whether we should differentiate genera by the presence or absence of lateral tubercles on the first and seventh segments, as van der Goot has done in creating a new genus *Siphonaphis* with *S. nymphae* as type. In this paper, therefore, the species has been retained in the old genus *Siphocoryne*.

It is also worth noting here that Schouteden had adopted the name *Hyadaphis* of Kirkaldy in place of *Siphocoryne*, Pass. on the grounds of priority (*Catal. des Aphides de Belgique*, 1906, p. 40). This name, in part, was taken by some American authorities, but its claim to priority has been discovered to be not very well founded; hence we again consider *Siphocoryne*, Pass. as the true and appropriate name.

The species met with in the Punjab have been dealt with separately in the following pages.

Stephensonia, gen. nov.

Type *S. lahorensis*, sp. nov. On Chrysanthemums.

Characters.—Body ovalish; green; clothed with capitate hairs.

Head with broad front and no trace of frontal tubercles.

Antennae smaller than body; spur of article VI smaller than III but larger than the base; sensoriae present on all antennal articles of alate females.

Wings rather long and slender; veins clouded with dusky pigment; membrane also somewhat smoky; venation normal Aphidine.

Abdomen with rows of knobbed hairs, and hardly any lateral tubercles.

Cornicles long, about one-fifth the body length, clavate only on the inner side.

Cauda conical, about two-thirds as long as cornicle.

Rostrum long, up to second coxae; very sharp pointed and readily withdrawn at the slightest alarm; third joint longer and much narrower than second.

Stephensonia lahorensis, sp. nov.

Host —Cultivated Chrysanthemums (*C. sinense*).

(*Vern.* Gul Daudi or Guldhudi).

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—A small-sized species, hardly visible when only a few are sitting in the indented margin of a leaf; rounded or broad oval in form; widest just in front of the cornicles and gradually narrowing towards the head.

Colour shining green, without mealy powder, very much resembling the leaves of the host.

Eyes brilliant red, without distinct stemmata.

Head yellowish-green, as long as broad; front large and convex, with bases of antennae quite wide apart, without any trace of frontal tubercles; some capitate hairs project anteriorly.

The absence of ocular tubercles is rather rare in Aphidinae.¹

Antennae short, about half the body length, proximal half of the colour of the head, the rest black; the joints are distinctly marked.

Spur of article VI slightly shorter than that of III; IV, V and base of VI sub-equal. The length of the basal part of VI is noticeable.

	III.	IV.	V.	VI.
Lengths ..	0.168	0.085	0.085	0.085 + 0.150 mm.

Thoracic segments of body colour, without lateral tubercle on prothorax and with a few capitate hairs.

Abdomen ovate, shining green; short hairs on body segments, placed in transverse rows and all knobbed distally, more prominent on the anal end as shown in the drawing.

¹ [Ocular tubercles, although small and little prominent, are distinctly present in the apterous form too! P. v. d. G.].

Pattern none, except yellowish patches surrounding the cornicular base and two faint stripes on the segments in front of the cauda.

Cornicles long and slender, of the colour of the body, but nearer the tip black; only slightly swollen in their distal one-third and on one side towards the middle line of the body; they reach to about the termination of the cauda. Scaly throughout.

Cauda broad conical, often reflected over the base; distal half beset with teeth, dusky; base broader, edged with black but greenish transparent and without teeth; one or two indentations laterally placed; it is about three-fourths of the cornicles.

Anal plate rounded posteriorly, dark brown; it lies on a swollen penultimate segment.

Genital plate much larger and concave anteriorly; it seems to be made up of two halves; less dark in colour.

Legs short and stout, enabling the insect to run rapidly, which it does on the slightest disturbance to the leaf on which it rests. Light green all over, including coxae; tarsi black.

Rostrum reaches half way between second and third coxae; very narrow and black in front; the ultimate segment is slightly longer than the one before it and about half as broad; bifid at the tip.

Measurements (average) :—

Body	1.12 × 0.52 mm.
Antennae	0.65 mm.
Cornicle	0.23 „
Cauda	0.15 „

Alate viviparous female.—They are never numerous, unless kept well protected under artificial conditions in the laboratory.

Small and active; with wings folded in the usual aphid way, over which the smoky veins are deeply marked.

Colour shining, light or deep green, oval in outline.

The pattern consists of three very faint carinal spots, hardly visible in some; two post-cornicular stripes; a row of black spots running along the lateral grooves, double on two or three segments just in front of the cornicles, as shown in the figure.

Head black, triangular, convex in front, bearing prominent red eyes.

Antennae almost wholly black, the segments distinctly marked off from each other. Spur of article VI smaller than III; base of VI subequal with V and a little smaller than IV :—

	III.	IV	V	VI.
Lengths	0.24	0.125	0.11	0.110 + 0.192 mm. (= 0.303 mm.)

The whole length is about 0.94 mm.

Sensoria scattered over the whole surface of the articles as follows :—

III.	13-15;
IV	7-8;
V	2-3.

The prothorax bears a transverse band on its anterior half, concolorous with the head.

Mesothorax yellowish green with shining black muscle elevations as usual over the dorsum, occupying about the half of its middle surface. Lateral black spots present.

Metathorax with a black stripe and another triangular elevation in front, narrower than the mesothorax.

Wings longer than usual, somewhat narrowed towards the tip; about three times as long as broad. Stigmal flattening dusky, the rest, including insertions, yellowish. All the veins are clouded with a blackish pigment; membrane also somewhat smoky. There is a prominent bend at the first forking of the cubitus.

Abnormalities are numerous; sometimes the first and second furcal are very close to each other, in others the stigmal is forked. One very strange freak is shown in the camera drawing of two pairs of wings; all the veins are branching even in the hind-wing.

Cornicles much like that of the apterous female, but more clearly incrassate towards their inner side and darker in colour. They narrow into a sort of neck just below the flanged tip; scaly.

Cauda, anal and genital plate very similar in both forms.

The capitate hairs are more marked on the posterior extremity on account of the small size of the segments.

Lateral tubercles not apparent.

Legs black at the coxae, distal femora and tarsi; tibiae brown. A dark band between hind coxae, narrow in the middle.

Rostrum brown-black, tipped and sharp-pointed; it can be readily withdrawn from the leaf; it reaches up to the second coxae.

Measurements :—

Body	1.16 × 0.50 mm.
Antennae	.. 0.94 mm.
Cornicle	0.22 ,,
Cauda	0.14 ,,
Wing	2.0 × 0.70 mm.
Wing expanse	4.35 mm.

The pupae are also stout in build, with yellowish thorax and black wing-pads; head blackish with a median white line; abdomen green as usual.

Natural history.—This pretty species is one of the smallest to be found in Lahore and has a curious habit of sitting in notches on the margins of leaves. It also crowds among very young and tender leaves and only when abundant attacks the lower veins and flower stalks. In the latter situation it is frequently to be noticed feeding in company with two other aphid pests of Chrysanthemums, *i.e.*, *Aphis malvoides*, sp. nov., and *Macrosiphum sanborni* (Gill.), about late December in the Gol Bag or gardens outside Bhati Gate.

Its small size and entirely cryptic colour, which quite matches with that of the leaves of its host, necessitated a careful examination to make sure of its presence.

The apterous viviparous females begin to come out about the middle of September when the rains are quite over and the young plants are "reotted" and "dressed up" with supporting sticks and kept in the sun. Soon after this the alate generation is produced, which migrate, flying off in the afternoon, to disperse the species.

Throughout the following months of October, November and December alate and apterous females are born promiscuously. The flowering period of *Chrysanthemums* is over and a few fresh shoots sprout before January. The plants generally about this time are either pulled out and kept in a heap or allowed to stand in the pots for the sake of shoots, which are ultimately removed by cutting them off from the parent plant. The Aphids also leave the old leaves with diminished nutriment for these growing shoots. They continue reproducing up to March, and in shady moist places or if kept protected in the laboratory even up to April.

They entirely disappear later, many of them being devoured by predaceous insects. How they tide over the hot summer months from April to September has not been yet found out, but the matter is under investigation.

So far no other alternate host has been discovered, and it is probable that the whole life-cycle is passed on *Chrysanthemums*. It is quite possible that at some period during winter the true sexes are produced which deposit the usual kind of eggs, but no definite information exists so far.

Insect enemies.—Three species of small ladybird beetles of the genus *Scymnus* keep an efficient control over its undue multiplication, and equally serviceable in this connection are the small "Pseudo Syrphids," whose blind larvae are seldom absent where the Aphid is to be found.

The only internal parasite bred from this Aphid is the small Chalcid, *Aphelinus* sp., which turns it jet-black.

Systematic.—The insect is evidently new to Science and possesses such distinctive characters of its own that it is very difficult to connect it, even remotely, with any of the existing Aphidine genera. Maculation of the wing veins is seldom met with in this tribe and capitate hairs are only present in some species of *Myzus* and *Phorodon*, but entirely absent in what may be called "Siphocoryne-like genera." Slight clavation of the cornicles is known to occur occasionally in *Myzus*, but the total absence of well-defined frontal tubercles at once separates this *Chrysanthemum* Aphid from *Myzus*.

In the structure and relative length of the antennae, along with the form of the cornicles, this Aphid has a considerable resemblance to *Rhopalosiphum berberidis* (Kalt). For the latter Walker once proposed a new genus *Liosomaphis* (1868) and Wilson (1910) has recently attempted to revive it. But the *Berberis* Aphid is now rightly considered to be a good *Siphocoryne* because it lacks secondary sensoria on the antennae of the apterous female.

It was at first very tentatively suggested by me to group these two insects together, but after examination of specimens from Europe there is little doubt that they are widely separated from each other.

In view of the combination of many unusual characters possessed by this Lahore

Aphid I consider it necessary to establish a new genus for it. The systematic position it would occupy would be somewhat intermediate between *Myzus* and the old genus *Rhopalosiphum* on one side and *Siphocoryne*, Pass. on the other.¹

It is a great pleasure to me to dedicate this interesting insect of Lahore to Professor J. Stephenson, D.Sc., I.M.S., as a token of the highest esteem in which he is held by his pupils and colleagues. A distinguished biologist himself, it is he to whom we owe practically all we have of Biology in the Punjab, and but for his active encouragement throughout and allowing me every possible facility in its study, this little work on Aphids could hardly have been undertaken, far less carried out to any completion.

The specific name, it is expected, would help to permanently associate his name with the city where he has carried out his many researches.

Brevicoryne, gen. nov.

Body elongated oval, stout, flattish; strongly mealy; two posterior segments arching over cauda.

Antennae much smaller than body, particularly of the apterous viviparous female; the spur is smaller than III.

Lateral tubercles usually wanting except in *Brev. brassicae*, Linn., where they are small, but distinct.

Cornicles very small in size; clavate on the distal half, narrowed into a neck below the vasiform tip; in apterous females they are more or less cylindrical, much thinner near the apex.

Cauda prominent, larger than the cornicles and long conical in form.

Other characters much as in *Siphocoryne*.

Three species are included under this genus:—

- (1) *Brevicoryne coriandri*, sp. nov.
- (2) *Br. chenopodii* (Schrank).
- (3) *Br. (=Aphis) brassicae* (Linn.).

They together constitute a fairly homogeneous group or subgroup; otherwise all three would form very aberrant species of *Siphocoryne*.

¹ [I am in doubt, whether the morphological characters of *Stephensonia lahorensis*, Das, really necessitate the erecting of a new genus, separate from *Siphocoryne* (Pass.) v. d. G.

The clavateness of the cornicles in *Stephensonia* is small, indeed much smaller than in true *Siphocoryne* species such as *S. berberidis*, *S. xylostei* and *S. ligustri*. But we find the same kind of slightly swollen cornicles in *Aphis padi*, L. (= *A. avenae*, Fabr.), and this species has now by nearly all authors been put under *Siphocoryne*!

The very short capitate hairs of *St. lahorensis* are a little more aberrant, since all true *Siphocoryne* species are nearly naked; however, this character alone is not sufficient to establish a new genus. Other separate characters, as mentioned by Mr. Das, such as the dark colour of the veins, are in my opinion of no generic value. It therefore seems advisable to me to sink the genus *Stephensonia* and place the species *Stephensonia lahorensis*, Das, back in the genus *Siphocoryne* (Pass.), v. d. G. P. v. d. G.J.

Brevicoryne coriandri, sp. nov.

Host.—On Coriander (*Coriandrum sativa*); *Vern.* Dhania.

Distinguishing characters.—A rather stout Aphid, clustering on the umbels of Coriander flowers and young fruits; body mottled or irregularly spotted greenish. Rusty red patches around the bases of the short brown cornicles, which are swollen in the alate female; cauda longer than cornicles; numerous sensoria on the 3rd and 4th articles of antennae; pupae generally with a reddish-brown intercornicular band.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body very mealy, thickset, resembling that of *Siphocoryne* (= *Aphis*) *brassicae*; egg-round, appearing a little flattish on account of the short stout legs.

Colour dirty greenish, the portion behind the cornicles and on the edges yellowish or lighter greenish; on the dorsum are conspicuous a number of irregularly scattered dark green spots; mottling is also noticeable in fresh specimens after removal of the white powder. Some (3-4) of the spots are between the cornicles, others on either side of the mid-dorsum, two or three are on the thoracic segments also.

A large, more or less circular spot, rusty-red in colour, around the base of each cornicle is never absent; a faint stripe on the penultimate segment and another smaller and darker line on the last segment.

Head brownish, broad, with black eyes and without frontal tubercles.

Front rounded or convex.

Antennae light greenish, distal part consisting of the 5th and 6th joint black; small, about one half or less than the body length.

Proportions from 3rd joint onward:—

	III.	IV	V	VI.
	13	7	6	5 + 11
Actual lengths	·21	·11	·10	·85 + ·19 mm.

Prothoracic segment without lateral tubercles and generally with a single greenish spot.

Meso- and metathorax with a blackish spot on the lateral edge above the insertion of each leg.

Abdomen without lateral tubercles; the last two segments arch over the cauda; the skin is marked out into clear polygonal areas.

Cornicles dark brown, similar or slightly deeper in colour than the patch around their bases; short, more or less cylindrical, not distinctly clavate, but constricted below the distal rim, which is black. They are here smaller than the cauda.

Cauda conspicuously long, light greenish, conical, the apical part above the waist almost cylindrical; base broad, hyaline, edged with black.

Genital plate blacker and apparently larger than the anal plate, the latter rectangular, the former somewhat crescentic or semicircular, concave anteriorly.

Ventral surface lighter in colour, with two or three blackish blotches about the level of the lateral grooves.

Legs comparatively short and stout; tarsi black, the rest light yellowish-green or slightly brownish, darker in individuals about to moult. Between the second coxae a short but clear transverse groove.

Rostrum arising from a dark face, greenish-brown, with the last joint dusky, reaches up to the second coxae.

Measurements :—

Body	1.70 × .86 mm. (average).
Antennae	0.81 mm.
Cornicle	0.13—0.20 mm.
Cauda	0.24 mm.

Alate viviparous female.—Body smaller; colour similar to the apterous female; dirty light green, deep anteriorly and light behind, with about six irregular dark spots; also a rusty area in the mid-dorsum.

There is no pattern on the abdomen except the reddish-brown patches around the cornicular bases, and three darkish spots on the carinae in front of the cornicles.

Head broad, pitch black, with similar antennae and eyes.

Antennae large, black, except for a very small basal part of the third article which is lighter, narrower and devoid of sensoria. The rest of this joint and the fourth are strongly tubercled and studded all round with sensoria. The spur and the third joint about equal in length or the 3rd a little longer.

Sensoria very many on the third, upwards of thirty-five (35); the fourth has about a dozen (12); often one or two on the fifth and sixth in addition to the two primary sensoria which have a distinct hair-rim.

All the secondary sensoria on III and IV have a double contour.

Length proportions :—

	III.	IV.	V	VI.
	20	10	8	5 + 17 (Ratio)
Actual lengths	0.33	0.16	0.13	.08 + 0.29 mm.

Prothorax green, with a black broad band near the anterior edge.

Meso- and metathorax of the usual form with black shining muscle bosses; a black stigmal spot on the lateral sides below the origin of the wings.

Wings large, with normal venation; stigmal flattening dark brown; veins light brown, well marked; insertions yellow. Cubitus faint near its base; its second fork arising about midway between its origin and the margin of the wing; tips of veins flattened slightly.

The absence of lateral tubercles on the sides is noticeable.

Cornicles dark coloured, rather small, of about the same size as the cauda; narrow below and gradually enlarging and becoming distinctly clavate or swollen, ending in a vasiform tip.

Cauda broad at base and proximal half; then narrowing and remaining of the same thickness up to the tip as shown in the illustration; crenulations extend right up to the base.

The anal and genital plates as well as the ventral surface is similar to that of the apterous female.

Rudimentary gonapophyses large, three in number.

Legs much darker, specially at the coxae, distal femora, tibiae and tarsi. There is a black band stretching between the third coxae.

Mesosternal bosses black, shining and four-lobed.

Rostrum reaches to the second coxae.

Measurements :—

Body	..	..	..	1.50 × .62 mm.
Antennae	..	..	..	1.15 mm.
Wing expanse	..	5.50—6.4 mm.	;	wing 2.95 × 1.19 mm.
Cornicle	..	..	..	0.15 mm.
Cauda	..	..	..	0.17 ,,

Alate male.—Remarkably similar to the alate female in its structural characters, but it can be readily made out by its *yellow* colour and somewhat slender body. The genitalia of course is the chief distinguishing character.

Head, antennae, band on prothorax, mesothorax, legs, cornicles and genital armature all black.

The antennae in one of the larger specimens has the following proportions :—

	III.	IV.	V.	VI.
	22	11	10	6+22
Lengths ..	0.35	0.19	0.16	0.10+0.35 mm.

The spur and the 3rd joint are equal; relatively to the body the antennae are longer than those of the alate female.

The sensoria are exactly of the same form and number on the 3rd and 4th articles as the alate females; in this character they differ from the males of other plant-lice, in which the males always possess many more sensoria. The additional sensoria (probably for want of room, as these joints are already crowded) are placed about 6-10 on the 5th, and about 3 on the 6th.

Wings smaller and narrower than those of the alate female; the membrane has a little dusky hue; relatively to the body they are fairly ample, but not voluminous.

Cornicles of the same type, only much smaller.

The cauda, raised upwards by the reduced anal plate becoming vertical, is very small and appears about the same size as the conical penis in the centre of the usual kind of genital armature.

The males vary a good deal in size; some are very small, others fairly large and nearly equal to the alate females.

The measurements below are from a large specimen.

Body	..	..	..	1.50 × 0.55 mm.
Antennae	..	..	..	1.25 mm.
Wing expanse	..	5.5 mm.	;	wing 2.5 × 1.10 mm.
Cornicle	..	..	..	0.10 mm.
Cauda	..	..	..	0.11 ,,

The males appear on Coriander in January, and quit the plants along with other migrant females soon afterwards; they probably have some alternate host which so far is unknown. It is also possible that they go to other Coriander plants, although no oviparous females have been collected at any time during the year. During March and April Coriander plants are again badly attacked. It remains to be determined whether these hatch from eggs laid on the plants or migrate from another host. The summer history after April to October is also obscure.

Hosts.—The chief host is *Coriandrum sativa*; occasionally a few stray specimens were captured on *Foeniculum* (Fennel) and *Carum capticum*, but they do not infest these plants. Coriander is often so much weakened that in bad attacks whole beds are killed. At the same time also a fungus (*Urophlyctis coriandri*) is seen on these plants, which causes smaller or larger blister-like swellings and a good deal of hypertrophy of the stems, leaves and fruits.

The aphids may be the cause of rendering the plants less strong and so less resisting to the spores of the fungus, thus causing a double injury, one direct and the other indirect.

The larger Coccinellids and Syrphids act as natural checks, but they are particularly liable to the attacks of a species of the fungus *Empusa*. Such specimens become reddish before death, instead of yellowish-brown as is the case when killed by *Entomophthora*.

The Coriander Aphid of the Punjab is evidently a different insect from a similar one in the West (*Siphocoryne foeniculi*, Pass.) known to infest several umbelliferous plants. The Western insect was originally described by Passerini (*Gli Aphidi*, 1860) from Italy, and Buckton published an account of the European insect with a coloured plate in *Brit. Aphidae*. There is little doubt that the Punjab insect, though having as its host a member of the same group of plants, is not identical with it.

Siphocoryne conii, Davidson, on hemlock, seems to resemble it in certain respects, but is differentiated at once by the lengths of the antennal articles and the relative size of the cauda and cornicles. The former, as given in the *Journ. Econ. Entom.*, II, p. 304, 1909, is much smaller than the latter in the ratio of 3 to 4.

There is no other *Siphocoryne* known to me that may be even remotely similar to it, and taking it to be an undescribed species I have named it after its host.

Moreover, from the typical genus *Siphocoryne* it departs in certain important structural features, especially in the form, size and relative lengths of the cornicle and cauda, as well as the general characters of the body, antennae and lateral tubercles.

In view of this it has been separated along with two other species into a small group comprising the new genus *Brevicoryne*. Diagnostic characters are given above and also in the table of genera under "Club-Cornicled Aphids."

***Brevicoryne chenopodii* (Schrank).**

Host.—Species of *Chenopodium*, specially *Ch. alba*.

Distinguishing marks.—The insect is often conspicuous by the pod-like galls—rather pseudogalls—into which it changes the leaves of the herbaceous weed men-

tioned above. Either the leaf is conduplicated by uniting its edges, or a part of its surface near one side is folded over the rest of the leaf and kept in that position. A kind of pouch is formed, open on one or both ends. This grows bigger and even hypertrophies, and when exposed to the sun turns pinkish-red, like true galls. Being swollen outwards it is quite roomy inside and contains bead-like drops of honey-dew, whitened by the copious powdery meal. Frequently it is quite full of teeming Aphids.

The illustration shows the galls of almost natural size on the branches; the one split open to show the interior is one and a half times natural size.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body thickly covered over with white powder, stout, thick-built and short-legged; elongated oval, often a little flat and drawn out posteriorly into a conspicuous cauda.

Colour greenish over the whole body, including cauda, which is lighter; distal half of antennae, eyes, coxae, tarsi and the anal and genital plates black. Cornicles and legs and a patch below the bases of the former brown.

Head about as long as broad, convex anteriorly, the centre slightly elevated; antennal pits far apart, their inner edges a little projecting towards the front; colour greenish-brown.

Antennae short; first three joints concolorous with the head, the rest black.

Articles III and VI (including spur) subequal; IV and V also subequal.

Lengths (average) from third joint onwards:—

III.	IV.	V.	VI.
0.220	0.085	0.085	0.066 + 0.160 mm.

The thoracic segments are distinctly marked off from each other and their dorso-lateral sides are somewhat raised above the general surface; lateral depressions large. The prothorax bears very ill-developed lateral tubercles.

Abdomen not much arched, generally similar to that of *Siphocoryne* (= *Aphis*) *brassicae*, L. and *B. coriandri*, sp. nov.; no pattern, except a circular patch below the bases of the cornicles.

Lateral tubercles hardly visible, absent on the seventh abdominal segment and a very small one if at all on the segment in front of the cornicles.

Cornicles brownish, small, almost cylindrical or only slightly incrassate about the middle, narrowing towards the flanged tip; the size is from one half to two-thirds that of the cauda.

There is no intercornicular band.

Cauda prominently long, light green, hairy as usual; it is almost cylindrical with a rounded tip; a constriction or narrowing above the broader base, then the breadth is uniform; turned upwards; the base is dark edged.

Anal plate large, rectangular, with distinct black borders.

Genital plate lighter in colour and slightly concave anteriorly.

Legs brownish and comparatively small; tibia greenish-brown; coxae dark.

Rostrum reaches a little beyond second coxae, brown in colour; the last segment

is narrow and pointed, quite black, and longer than the preceding one in the ratio of four to six.

Measurements :—

				Average.
Body	..	..	..	1.50 × .65 mm.
Antennae	..	..	..	0.75—0.90 mm.
Cornicle	..	..	..	0.11 mm.
Cauda	..	..	..	0.19 mm.

Alate viviparous female.—Prevailing colour of body green, with preponderance of black as usual; mealy.

Head black; front broad, antennal pits wide apart with their inner edges projecting anteriorly almost to the level of the median ocellus.

Eyes with large ocular tubercles; black.

Antennae almost throughout black, just the basal part lighter; much longer proportionately than the apterous female. Articles III and VI, and IV and V are subequal; scaly from 3rd joint onward.

Length proportions :—

	III.	IV.	V.	VI.
	22	9	9	5+17
Lengths ..	0.36	0.15	0.15	0.08+0.29 mm.

Secondary sensoria circular, only ten or eleven present on the 3rd joint, almost equal in size and situated along one line on the ventral side.

The prothorax has a broad band concolorous with the head; no visible lateral tubercle.

Mesothorax as usual with shining black dorsal and ventral bosses formed of muscles below, divided into four pieces, occupying about the middle half of the dorsum and three-fourths of the mesosternum respectively.

The metathorax bears a transverse band, not reaching the edges, and in front of it another semilunar black elevation.

Abdomen ovate, wholly green; the black eyes of the embryos can be seen through the skin; three spots on carina, one short transverse band on the first and another on the last abdominal segment.

No lateral tubercles on the sides or small flat ones in front of the cornicles.

Cornicles brown, small, narrow at base, almost appearing to arise from pits; they gradually become swollen and end in a distinctly vasiform tip and are about one half the size of the cauda.

Cauda long, greenish, broad at base and with rounded tip, much like that of the apterous female.

Anal and genital plates also similar.

The rudimentary gonapophyses are three in number in both this form and the apterous female.

Legs much darker and longer.

Coxae black; in front of the hind coxae there are two black triangular spots, one on either side.

Rostrum up to about second coxae.

Wings long and rather slender, not very broad; veins black and distinctly marked. Stigma dark brownish; its basal parts and the insertions greenish-yellow. Cubitus reaches up to the sub-costa. Stigmal vein with a gradual curve throughout.

Measurements :—

Body	1.50 × 0.60 mm.
Antennae ..	1.16 mm.
Wing expanse .	5.10 mm.; wing 2.20 × 0.76 mm.
Cornicle ..	0.10 mm.
Cauda	0.19 ,,

Natural History.—The insect seems to appear some time about the middle of December, the earliest date in my collection being 19th December. At this time one notices a few leaves, nearer the base than the top of the plants, either wholly or in part changed into galls. As explained above, there is always an opening to them, either at one or at both ends. Through this opening the Aphids can creep out. It is not usual to find alate females inside, but they are often found sitting more or less isolated on the under sides of the leaves. It was easy to find out the reason for this from plants kept under observation in the laboratory.

Up to the pupa stage, *i.e.* up to the time when the active nymph has to cast its final moult, it stays inside the gall, but as the space inside is very limited and the gall is often crammed with young aphids, the pupa almost instinctively understands that it would be unable to expand its wings when it casts its skin and the crumpled new wings are to be inflated with air. Creeping out of the gall it sits quietly on the sheltered side of the leaf where it can, for some time, obtain food as well, though it does not appear to take much before ecydysis. After moulting and fully expanding its wings the females stay on the plant for considerable periods before flying off to new ones.

Very young leaves are always attacked and if they have not had time to unfold or grow the whole leaf is conduplicated and inflated; otherwise only a part of the leaf forms the pseudogall and the rest remains normal. In bad attacks almost all the upper leaves of the branches and more particularly of those which terminate in the inflorescence turn into small pods as is shown in the illustrations.

If the food supply of the species is interfered with, by injuring the branch which bears the galls, all the insects come out and travel to other parts of the plant.

Owing perhaps to the fact that *Chenopodium* is more or less in leaf throughout the year, it has not been possible yet to secure the males and the true females that lay eggs. The most active reproduction takes place during March and April when it may be found in almost any shady place, along water-courses, in the fruit orchards and gardens on all sides of Lahore. But it seems to be fairly active also in the summer months; along the banks of the river Jumna at Delhi it was flourishing well in the latter part of July (23rd July 1913).

Myrmecine ants regularly attend this Aphid to remove the honey-dew, which

often collects in very large globules inside the galls; the mealy coat of the insect protects it from becoming soiled with-honey-dew.

Natural enemies.—The openings in the galls serve as passages for the exit and entrance of parasites and predaceous insects as well.

A species of *Lysiphlebus* is extremely active in reducing its numbers, and there is always a large percentage of "mummified" and inflated dead or dying plant-lice, fastened to the surface of the leaves by the parasitic grub inside. Any number of the *Lysiphlebus* can be secured by placing pot plants or twigs under a bell jar; they copulate freely in captivity and parasitise other aphids by entering through the holes in the galls.

Small Coccinellids of the genus *Scymnus* act as useful checks, and the flocculent larvæ of the one-spotted *Scymnus* are always quite abundant.

Systematic.—It has been suggested to me by an American correspondent that probably this *Chenopodium* Aphid is the same as *Aphis chenopodii*, Schrank.¹ But both Schouteden (*Cat. Belgian Aphids*, 1906) and Buckton (*l.c.* III, p. 37, pl. xlv) consider the latter a synonym of *A. atriplicis*, Linn., and the description of *atriplicis* as given by Buckton (*Monog. Brit. Aphids*, 1887) certainly differs very much from that of the Punjab insect. Provisionally, therefore, I have retained it as Schrank's species. Furthermore, it does not belong to the genus *Aphis* but to my new genus *Brevicoryne*.

It is also possible that a new genus of Del Guercio, *Uraphis-Hayhurstia* (Patch, *Host Index of World's Aphididae*, 1913) of which the type is *A. atriplicis*, might turn out to be the same as *Brevicoryne*. In that case Del Guercio's name should have priority. The Italian work is at present inaccessible to me in India.

***Brevicoryne (Aphis) brassicae* (Linn.)**

(European Brassica plant-louse).

Literature :—

Buckton, *Brit. Aphids*, II, p. 33 (1875); accurate colour description and plate.

Essig, *Pom. Coll. Jour. Entom.*, III, 3, p. 323 (1911); illustrated detailed account.

Herrick, *Jour. Econ. Entom.*, IV, pp. 219-224 (1911); life-history and methods of control.

Ind. Mus. Notes, II, 6, p. 167.

Lefroy, *Ind. Ins. Life*, p. 747 (1910).

The Agricultural Department of India have also issued a coloured plate for popular purposes.

There are numerous other references to this well-known and cosmopolitan species of plant-lice since Linné first gave it a name in *Syst. Nat.*

The insect in Lahore has been found rather sparingly on a few occasions either

¹ [It is nearly certain that the species described above by Mr. Das is identical with *Aphis chenopodii*, Schrk., of which species we have a fairly good description by Kaltenbach (*Die Pflanzenläuse*, 1843, p. 107). Kaltenbach mentions as a synonym *Aphis atriplicis*, L., and this name being older must have priority. The *Aphis atriplicis* of Fabricius is only one of the numerous synonyms of *Aphis rumicis*, L.

I have received specimen of *Brevicoryne (Aphis) atriplicis*, L. from Mr. J. J. Davis of Lafayette (Ill. U. S. A.), which entirely agree with the descriptions furnished by Mr. Das. P. v. d. G.]

on cabbages or on turnips. It is never so bad as reported from other countries, and hardly deserves the name of "Mustard Aphis" in India, where it is replaced almost entirely by a much worse Aphid, described below as *Siphocoryne indobrassicae*, sp. nov. The difference between the "European Brassica louse" and "Indian Brassica louse" is that the latter is never so mealy, and has a pattern of hyaline non-pruinose spots instead of deep black ones; the cornicles in the latter again are much larger; the sensoria on the antennae of the alate female are present on both joints III and IV and never so numerous as in the former. Moreover, the black bands on the abdomen of the Western insect are quite absent here. For other differences see the descriptions and figures.

The systematic position is of interest. Traditionally from Linnaeus downwards all the writers have given it a prominent place among the species of the genus *Aphis*. This genus, as at present defined and comprising species such as *A. gossypii*, *A. malvae*, *A. nerii*, etc., cannot, through any stretch of definition, be made to include a form like this species. The shape, structure of antennae, cornicles and cauda, taken in conjunction with the relative lengths of the two latter, are widely different from typical species of *Aphis* (Mordwilko and van der Goot).

Van der Goot, to my knowledge, was the first to remove the species from the genus *Aphis* and transfer it to *Siphocoryne*, Pass., with which indeed it has a much greater affinity than with *Aphis* (*Zur Systematik der Aphiden*, p. 93, 1913). But even he had pointed out, at the time, that the species was somewhat aberrant. In fact it deviates considerably from the types of that genus, in several essential characters. The cornicles, for instance, though clavate, are smaller than the cauda; the reverse is true for *Siphocoryne*. The case is similar with some other features mentioned above.

In view of this I have tentatively suggested, in consultation with Mr. van der Goot, to place this old Linnean species under a separate genus, *Brevicoryne*, along with two more similar plant-lice on *Chenopodium* and Coriander.

Siphocoryne indobrassicae, sp. nov.¹

(THE INDIAN MUSTARD APHID).

Vern.—Sarson ka tela.

This aphid is more or less a serious pest of all the *Brassica* crops and particularly of mustard and rape, on which in certain seasons, as in 1913, it becomes uncommonly bad. Almost all the flowering shoots are thickly covered with plant-lice, and the

¹ [This species, called by Mr. Das *Siphocoryne indobrassicae*, is apparently identical with *Aphis pseudobrassicae*, Davis, of which a very accurate description has been published by Mr. J. J. Davis (*Canad. Entomologist*, vol. 46, 1914, p. 231); the descriptions of the apterous and alate female, as furnished by Mr. Das, have therefore been omitted here.

The same species is known to occur in Java; in the U.S. of America it is recorded from the States of New York, Indiana and Texas. An American specimen, received through the courtesy of Mr. J. J. Davis, agrees with the descriptions of Mr. Das and myself. Of course the species distinctly belongs to the genus *Siphocoryne* (Pass.) v. d. G. P. v. d. G.]

sickly plants present the appearance of being oiled over, on account of the profuse honey-dew that is excreted and which falls on the lower parts.

Myzus persicae is frequently found along with it in varying proportions, but it can easily be made out even with the naked eye.

It is also quite distinct from the European *Aphis brassicae* (Linn.), but apparently has been confused with it, and it is in all probability this species that has been referred to as such in Lefroy's books "*Indian Insect Life*" and "*Indian Insect Pests*," as well as in the list of vernacular names for common pests. A plate has also been issued by the Imperial Entomological Department at Pusa, which is quite good from an artistic, but of little value from a scientific, point of view.

It is quite likely that the *Aphis brassicae*, Linn. as mentioned in *Indian Museum Notes* is also more often this Indian Aphid than the European insect. The latter is also met with in India, and in this paper an account of it is given under *Brevicoryne brassicae* (Linn.). It is not at all so abundant and common, and when present it chiefly attacks cabbages or turnips, at least this is the case in the plains and hills in the Punjab.

The distinguishing features of this Aphid are the following :—

- (1) A very slight meal on the body (abundant in *A. brassicae*, Linn.).
- (2) Two median rows of squarish spots and two more on the lateral sides. These spots appear bright and shining in contrast with the dull greenish-white of the body. At these spots meal is entirely absent, so that they become easily wet with water.
- (3) Posterior abdominal segments banded.
- (4) Black clavate cornicles which are longer than the cauda ; a very prominent genital plate and many sensoria on the 3rd and 4th antennal article of the alate female.
- (5) The oviparous females have from twelve to eighteen eggs.

Apterous oviparous female.—This form appears in November and December on turnips (*Brassica rapa*) and mustard (*B. juicea*) and is quite similar to the apterous viviparous female in form and colour.

Antennae black, except the basal part of the 3rd joint.

Cornicles slightly smaller, not so clavate and narrowed at the tip.

Cauda broadly conical without the middle constriction.

Posterior legs characteristically swollen and smaller.

The hind tibiae in the oviparous female are about (5/6) five-sixths of those in the apterous viviparous female (45 : 56). Its proximal two-thirds is beset with numerous small, rather irregular sensoria, often in groups of two or three ; their rims are not so well defined as of those of the antennal ones in the alate female.

The body, if the eggs have not been laid, is distended. The number of eggs is quite unusual ; from twelve to eighteen may be dissected out from a single individual. This is even more than the number that are to be found in much larger Aphids of the Lachninae tribe.

Among Aphidinae the number of eggs normally does not exceed a few and very often it is only one. The European *Aphis brassicae*, Linn. (according to Harrick in the *Jour. Econ. Entomology*, vol. IV, p. 219, 1911) lays on an average about four eggs.

When freshly laid the colour of the eggs is yellowish, mottled on the surface with greenish dots. The micropylar side is narrower than the other and constricted into a greenish cap. As usual the eggs in a few days turn jet black and remain so till ready for hatching some time in the spring.

The males are likely to be alate, but none have been secured. They may be emerging a little earlier in the season, about the beginning of November.

Life-history.—This is by far the commonest Aphid in the plains during the winter and spring months. It makes its appearance soon after the mustard plants have put forth their stems and are a few inches high, about October. Active reproduction goes on in November and December on various cruciferous plants like the cabbage, cauliflower, radish, turnip, etc., which are all winter crops in India.

Severe loss is inflicted on these at this time. Young mustard shoots form a favourite vegetable (*Sarson ká ság*) in the villages; the attack in 1913 was so bad that very little of it was available in places where it used to be plentiful in former years, and there was a widespread complaint against this destructive pest.

On warm evenings the winged females in large numbers form a conspicuous part of the aerial insect fauna of the season. They are not unlike swarms of may-flies and frequently fall into the eyes of those walking briskly or riding a bicycle. At these times large numbers may be collected by hand without the aid of a net.

The sexes are produced in December; only oviparous females were secured, laying eggs freely on turnip and mustard plants. Probably the alate (?) males are produced earlier.

The eggs on cabbages seem to have little chance of hatching as there is a succession of two or three crops in the season. There are abundant colonies of parthenogenetic females, which reproduce actively after the eggs have been laid. They continue to do so during January and February, when again there are large swarms in early March which is the flowering time of mustard. The fields look like vast sheets of beautiful yellow with a delicate tinge of green and the occasion is celebrated as a fair (*Basant*), on which the people wear yellow turbans. Numerous Aphids are particularly attracted towards this coloured head-dress, though some of them settle on white clothes as well.

Sexual individuals have not been found to be produced, neither is it known with certainty whether the winter eggs hatch at this time or not. If they do, the stem-mothers must be mixing their generations with those of the viviparous females from winter. When the mustard crop is changed for radish and cabbage they breed on the latter up to early June, but in diminishing numbers and even become scarce in May.

The summer history is not definitely known; probably they are present on stray plants in cold moist places. They are abundant in the hills and from there migrate to mustard plants again in September or October. It is also likely that later it may be found that they pass the summer and rainy seasons in the egg stage.

It appears that the species originated in some colder regions in the hills. The life-history would be quite adapted to the conditions there. In autumn (about November) in such places the eggs are deposited and in this state the species tides over the severity of the cold winter. In spring these hatch and the insects reproduce throughout the summer and rainy season till the sexes arise again.

In the plains, probably on account of heredity, egg-forming females are seen about the same time, though the species has to suffer no inconvenience from the winter. Whether, as a provision against the summer, eggs are laid a second time is still to be discovered.

The species falls a prey to numerous predaceous and parasitic insects that keep it in check in normal years.

As the bodies of most of these Aphids touch each other when feeding, it makes them particularly liable to the attack of the Fungus "*Entomophthora aphidae*," which destroys them in large numbers. Fungus-killed Aphids turn yellow and soon shrivel to a brownish scale.

***Siphocoryne nymphaeae* (Linn.).**

Synonym.—*Rhopalosiphum nymphaeae*, Koch.

Hosts (in Lahore):—

- (1) *Lemna* sp. (in Chhota Ravi).
- (2) *Melumbium speciosum* (Shalimar and Botanical gardens).
- (3) *Scirpus lacustris* (Shahdara).

Numerous other aquatic plants have been reported as hosts of this very widely distributed species.

Literature.—Since Linnaeus' time (1767) numerous writers on Aphids have figured, described or listed this semiaquatic insect. The monographs of Koch (pp. 26, 44) and of Buckton (VI, p. 12) give accurate illustrated accounts. Essig (*Pom. Coll. Jour. Entom.*, IV, 3, pp. 793-797, 1912) has lately furnished a morphological description with a fair summary of the previous literature. Patch (*Maine Agric. Exp. Station Bull.* 202, 1912) figures the antennae. Davis (*Entom. News*, p. 245, 1910) and Cockerell (*Science*, p. 764, 1905) give useful accounts. The insect has been listed in Lefroy's *Indian Insect Life*, p. 747.

Distinguishing characters.—A rather large insect of a dark olive-green or reddish-brown colour (on *Scirpus*), often shining; sitting singly or in pairs on floating *Lemna* fronds, or in large numbers on water-lily leaves, or in rows along the ventral surface of marshy *Scirpus*. A distinctive feature under the microscope is the clearly-marked polygonal areas on the skin, formed by the pores of wax-secreting glands; also the long, distally clavate cornicles; the spur is longer than III; about 17 sensoria on the alate antennae.

The size, antennal lengths, sensoria and measurements of the cornicles and cauda of the Indian species agrees very well with the description of the insect by H. O. Essig from California.

Miss Patch has published a figure of the antennae and cornicle, with notes on the size and antennal lengths, from Maine (Orono), which is different. The specimens

that we found of this species on the peaches as "return migrants" are almost exactly similar however. It is possible, therefore, that at the time Miss Patch collected her specimens, those generations were being developed which later fly off to other hosts in company with the males.

The antennal proportions of such a return migrant collected in December are as follows :—

	III.	IV	V	VI.
	25	18	16	9+33
Lengths	0.40	0.30	0.26	0.15+0.55 mm.

The size is also larger as seen from the body measurements given below :—

Body	2.1 × 1.05 mm.
Antennae	1.80 mm.
Wing expanse	7.50 ,,
Cornicle	0.26 ,,
Cauda	0.14 ,,

The number of sensoria, instead of being 13 or 14, is from 17 to 24 on article III and 3 to 4 on IV

The males that were collected on the peach at the same time are much smaller. As I am not aware if any description of these males has ever been published I give a detailed one below. The oviparous females were not to be found in December; probably they form in January, but observations were not carried on into that month.

The *alate male* is much smaller and narrower proportionally to the alate viviparous female, along with which it migrates to the peach plant in December.

Head pitch black, shining; about twice as broad as long and broader than the prothorax, which has a conspicuous black band on its anterior margin and two spots latero-dorsally behind.

Antennae about as long as body, black; 3rd article very stout, about half or three-fourths of the 6th, with numerous sensoria.

Length proportions :—

	III.	IV	V	VI.
	21	14	12	6+28
Lengths	0.35	0.23	0.20	0.10+0.46 mm.

The sensoria are scattered all round; their numbers are 25 on III, 19 on IV and 8 on V

Thorax and wings similar to alate viviparous female, only smaller in size.

Abdomen, colour light yellow at margins outside the lateral grooves, in the middle dark green; strongly segmented so that the shining abdominal rings appear green-banded. Post-cornicular segments concolorous with the edges.

The pattern consists only of 3 very faint lateral spots and faint rusty areas behind the cornicles.

The end of the abdomen appears truncated on account of the swollen penultimate segment bearing the genital armature.

Cornicles clavate only on their distal halves which are dark brown; the narrow proximal part is of the body colour; the vasiform tip is black and reaches to the base of the cauda.

Cauda edged with black, raised upwards; anal plate black and narrow.

The genital armature is of the usual form, consisting of two black "claspers" bounded by hoop-like ridges behind and laterally; a light yellow penis projects conically from between their posterior ends medially.

On the ventral surface there is a row of depressions along the lateral grooves.

Legs, rostrum, etc. like the alate female.

Measurements :—

Body	...	..	..	1.50 × 0.50 mm.
Antennae	..	..	..	1.49 mm.
Cornicle	..	..	..	0.25 ,,
Wing expanse	..	..	..	6.0 ,,

The specimens were collected from the ventral surface of peach leaves (*Prunus persica*) on young plants near Chhota Ravi on 28th December, 1913, along with migrant alate females depositing young ones.

Life-history.—This species therefore appears to have the same life-history as most other plant-lice, parthenogenetic reproduction continuing during the year; in December alate migrants and males return to the peach and in all likelihood lay eggs there which ought to hatch in the spring. After one or two generations on peaches the alate females must again probably return to aquatic plants.

Enemies.—Besides the usual predaceous insects and spiders we have reared the parasite *Triox* from this species. The dead Aphid is raised upon a tent-like cocoon formed by the larva inside; the imago emerges from one side of the cocoon and not through a hole cut into the body of its victim, as do other Braconid and Chalcid parasites.

Systematic.—The water-lily Aphid possesses small frontal tubercles, well seen in the apterous viviparous female, but not so distinct in the alate female. The presence or absence of these tubercles was taken as the chief character for separating the club-cornicled genera *Rhopalosiphum* and *Siphocoryne*. As this very character here is a contestable point, some writers place it under one genus and others under the other. In most of the earlier works the species is described under *Rhopalosiphum*. But if we accept van der Goot's emended definition of *Siphocoryne*, in which he includes only those species that lack sensoria on the antennal articles of the apterous viviparous female, then this Aphid very rightly belongs to *Siphocoryne*. On other grounds also the trend of opinion is to regard it as belonging to this genus. However, some authorities, like Prof. Theobald, still hold to the old view of grouping it under *Rhopalosiphum*. Van der Goot has further thought it desirable to bring it under a new genus altogether, on account of the presence of lateral tubercles on the abdominal segments, which are absent in the type-species *S. xylostei*, *S. foeniculi*, etc. He proposes to call this new genus *Siphonaphis*. It is still a point to be settled whether we

can attach generic importance to these tubercles. I have therefore, not finding myself in entire agreement with him in this, retained it under *Siphocoryne*.

***Siphocoryne avenae* (Fabr.).**

(European Grain louse).

Synonyms.—*Aphis avenae* (Fabr.); *A. padi* (Kalt.).

Literature and synonymy.—This species is up to the present known in Europe as *Aphis avenae*, the original name given by Fabricius in *Entomologia Systematica*, vol. IV, p. 214, 1794.¹ American authors almost unanimously describe it under *Siphocoryne* since Pergande's excellent memoir on "Aphids affecting grains and grasses of the United States" (*U. S. Department of Agric. Bull. No. 44*). He gives a complete account of its life-history and a description of the various forms with a bibliograpy and a synonymic list. References to it are to be met with in many Reports and Bulletins issued by Experiment Stations mostly under the name of "Grain and Apple Aphis," by Thomas, Gillette and Taylor, Patch, Wilson and others. An accurate and detailed description, though differing in certain respects from the insect as found in India, has been given by Essig (*Pomona Coll. Journ. Ent.*, IV, p. 791, 1912), apparently under the wrong name *Aphis maidis*, which is altogether a different species and is dealt with elsewhere in this work.

In India, in the plains, one is apt to find mostly the winged forms only and I have so far never discovered the apterous individuals unless I have specially hunted for them or reared them under glass vessels in the laboratory.

From late October onwards throughout winter one finds isolated winged Aphids on the blades of young plants of wheat, barley or avena. There are seldom more than two or three individuals on one plant. They are either *Aphis maidis* or *Siphocoryne* (*Aphis*) *avenae*. The latter can be at once recognised from the former by its large ample wings, deeply marked veins, very black antenna in which the spur of the sixth joint is more than four times the length of the base, and brown cornicles with a concolorous band between them. The apterous forms remain underground and are seldom met with unless one digs them up.

The apterous female is to be found with her brood of a few young on the white stalk of the cotyledon, between the permanent position of the wheat or avena-seedling and the seed, as shown in the rough diagram. The colour is often dull greenish or darkish but never black as noted by Western writers, and one invariably notices a russet intercornicular band. The largest specimens are very often wholly russet brown, thick built, with arched backs and quite plump.

When noticed for the first time by digging up a few rather weak-looking seedlings in the wheat and avena fields in November, they were attended by the brown and black ant (*Meranophus bicolor*). The antennae were invariably five-jointed,

¹ [Since the name *Aphis padi*, L. has older rights than that of *Aphis avenae*, Fabr., the correct name of the species mentioned here must be *Siphocoryne padi*, L., or better still *Siphonaphis padi*, L., as I have pointed out elsewhere (v. d. Goot, *Beitr. z. Kenntn. der holl. Blattläuse*, p. 241). P. v. d. G.].

and the description very similar to that given by Pergande for the "stem-mothers," which hatch out from the eggs in early spring in the United States, but not having read an account of them then it was difficult to guess that the root-feeding apterous form, so different in size and colour from the winged insects on the plants, could be the same. Seedling experiments in the laboratory were started to establish their identity.

Alate females were brought in from the fields and fed on young seedlings which were constantly changed, the young being carefully removed with a camel hair brush. The greenish young, with their reddish intercornicular band, changed in colour as they grew in size after each moult. The russet colour gradually spread ultimately over the whole body.

A second series of experiments were at the same time continued with apterous females and a few pupae from the underground parts of the seedlings. The winged females produced from these were similar to those found on the plants, and the apterous females that developed in the tubes were in no way different to those usually met with underground.

Conclusion.—The conclusion that I arrived at is that this form has developed a habit of feeding on the parts of the seedlings below the surface. The winged forms creep out and spread the species to different plants and fields. In March and April they may again be secured on the rhizomes of the common *Cynodon dactylon*, in moist places.

Loss.—The species has been, in my opinion, the cause of very considerable loss to wheat fields, although its existence has been so far altogether unnoticed.

Natural check.—The only check that nature has provided is a small blackish *Scymnus* (*sordidus*?) that feeds on it in the larval and imago stages. Below ground it is singularly free from the attacks of internal parasites as well as from Syrphid larvae.

Genus *Toxoptera* (Koch).

Toxoptera is an easily recognisable genus, on account of its possessing structural features which combine a peculiar wing venation with the rest of the characters belonging to the subfamily Aphidineae. The cubitus in the fore-wing is only once forked, while in other genera it is forked twice. This is the normal condition in *Toxoptera*, while in others only abnormal individuals of this type are met with occasionally.

In other respects it very much resembles either a *Myzus* or an *Aphis*.

The species definitely recorded from India so far appears to be only one; the cosmopolitan *Tox. aurantii* (Fonsc.), which is known from Europe, America and Asia. It has been reported from Bengal, Southern India and the tea-growing hill stations. But the orange plant, its chief host in the neighbourhood of Lahore at least, seems to be quite immune as I have never collected it here on the orange.

Tox. aurantii is the same as the insect named for the Indian Museum by Buckton as *Ceylonia theaeicola*, upon tea bushes (vide *Ind. Mus. Notes*, vol. II, no. i, p. 40, and *Ind. Ins. Life*, p. 748). It has been referred to again in *Indian Museum Notes*,

vol. III, no. i, p. 40, from tea gardens in India. I am not giving a detailed account of this insect as it is not indigenous to Lahore.

Leaving out *Tox. aurantii* therefore, so far unnoticed in the vicinity of Lahore, one collects usually three different species, recognisable with comparative ease from their colour and the host-plants.

(1) *Toxoptera graminum* (Rond.)

Light green in colour with similar black-tipped cornicles; it infests graminous crops such as wheat, avena, etc.

(2) *Toxoptera cyperi* (v. d. Goot).

Dark green in colour, more or less variegated, with black cornicles; it attacks mainly *Cyperus rotundus*, "Motha" or "Dila" grass.

(3) *Toxoptera punjabipyri*, sp. nov.

Body colour black, but appears slate-grey on account of whitish meal; its host is pear and plum the young leaves of which it conduplicates.

Separate accounts of these are given below.

Toxoptera graminum (Rond.).

This insect was first described from Italy by Rondani, who noticed it in huge swarms during 1852. It has come into great prominence by becoming a serious wheat-pest in U. S. of America, where it is known as the "Green bug" or the "Spring grain aphid."

Passerini has given the description of the Italian insect in *Aphidide Italicae*, p. 28, 1863. Numerous notices are contained in the Bulletins and Circulars of the U. S. Department of Agriculture and the Reports issued by various experiment stations, written mostly by Pergande, Washburn, Webster, Sanborn, Hunter and others.

The most complete and very profusely illustrated work, with elaborate experiments on its parasitisation and consumption by natural enemies, as well as the influence of environmental condition on the "Green bug" and its parasites, is to be found in the *Bulletin of the Kansas University*, vol. IX, pt. 2, 1909, by S. J. Hunter and P. A. Glenn; a very valuable publication indeed. Bulletin 38 (1902) and Circulars 85 and 93 (1907 and 1909) of the U. S. Department of Agriculture, Bureau of Entomology, are also useful. As the Indian insect is identical, no further description of it is given here.

In the Punjab this *Toxoptera* has been most commonly collected from wheat, avena, barley and on *Cyperus rotundus* and *Cyperus niveus*.¹ A number of individuals may be found feeding on *Cynodon dactylon*, the common Dhoob grass in April or early May.

¹ [It is a little doubtful whether the statement of Mr. Das as to *Cyperus* being a food-plant of *Toxoptera graminum* is quite correct, since this Aphid has so far been known only to attack Gramineae. Perhaps Mr. Das may have mistaken for *T. graminum* a light-greenish *Toxoptera*-species on Cyperaceae, not uncommon in Java too and described by me as *Toxoptera minuta*, sp. nov. (v. d. Goot. *Zur Kenntniss der Blattläuse Java's*, p. 86). P. v. d. G.].

Life-history.—In its essential details the life-history of this so-called “Green bug” does not materially differ from those of other Aphids. It has been more or less thoroughly worked out in America, and its course in India appears to be very nearly the same. The details, however, have not as yet been worked out in India, and I am not aware if the Agricultural Department of India have taken any notice of this pest. So far there is no mention of its occurrence in any of their Bulletins or Memoirs issued from the Research Institute at Pusa.

Natural enemies.—In normal years it is kept in check by the various predaceous insects and their larvae, and is also extensively parasitised by *Lysephlebus* sp. The Fungus *Entomophthora aphidi* was observed killing numbers of them in wheat fields along the Ravi in March.

Possible source of danger.—As it has been shown by its past history in Europe and America that its outbreak in any year might become extremely serious, it would be worth while to look upon it as a possible dangerous insect. In the words of Prof. Sanborn of America, “Whenever the natural conditions permit this aphid to flourish, it can devastate all the wheat and oats that may be planted on its latitude of infestation. The financial losses are almost inconceivable” (*Bull. U. S. Dept. Agric.*, no. 60, 1906).

***Toxoptera cyperi* (van der Goot).**

Host.—*Cyperus rotundus*.

Vern. “Motha” or “Dila.”

Distinguishing features.—Twice a year, in September and November, and March and April, this Aphid is often seen abundantly, on the lower surface of the common *Cyperus* (“Motha” or “Dila” grass) sitting in rows one behind the other.

In colour it is dark green, almost black with variegated or mottled abdomen; jet black, long antennae and cornicles, with a brownish intercornicular band; the deeply marked veins of the wing and the cubitus which is forked only once are characteristic.

Almost all the species of the genus *Toxoptera* are of a destructive nature. *Cyperus* would often be found quite weakened and ultimately killed by the incessant drain caused by individuals of this species.

Hunter, in his “Studies of Parasitism,” has demonstrated that *Toxoptera graminum* (Rond.), though much smaller in size than the common grain louse *Macrosiphum granarum*, inflicts much severer injury on wheat than the larger Aphid. Nineteen *Tox. graminum* adults would kill a healthy plant of wheat in about eleven days, while twenty *Mac. granarum* adults, after the same number of days, would do a similar plant comparatively little harm (Hunter, *Kansas Univ. Bull.*, vol. IX, no. 2, 1909).

Injury to plant.—We have found here the case with *Tox. cyperi* to be more or less similar. Two adult apterous viviparous females were placed on a healthy vigorous *Cyperus*. The plants and Aphids were protected under a lamp chimney in the usual way, in November. It was observed that after twenty days the plants turned yellow and died. Of the insects most of the young changed into pupae and later developed into alate females.

This perhaps is the only way of securing specimens of the winged insect, as ordinarily in the field very few of them are to be noticed on the plants, where one usually sees only apterous females and young.

Time of appearance.—The Aphid is in evidence about March, and continues to be so during April and even May. After this it either hides itself or migrates to cooler places. It has not been possible up to now to follow up its summer history and to determine the summer hosts. We meet it again in September in Lahore. Near the base of the Siwaliks and the Himalayas in Saharanpur and Dehra Dun districts I have collected it in July and August. From September onwards it continues breeding till its disappearance in November. Sexual forms have not been collected, but in all likelihood they are produced at this period, the species wintering in the eggs which hatch in March. No plant of any economic importance is its host at present.

Distribution.—It seems to have a wide distribution in India. I have collected it from various localities throughout the Punjab, United Provinces, Bihar, Bengal and most of Central India. Probably it is present in other provinces as well, and possibly extends towards Java and the countries around.

Name.—The insect appears to be undescribed, at least no description is available yet. We have been calling it after its host provisionally. Recently mention has been made in a footnote by van der Goot ("Zur Systematik der Aphiden," 1913) of a Javanese species that he calls *Tox. cyperi*, n. sp. It is very probable that the Indian insect is identical with the one found in Java. Specimens have been asked for in exchange.

The insect has, since writing the above, been found to be quite similar to the Java one.

***Toxoptera punjabipyri*, sp. nov.**

Hosts.—*Pyrus communis* (Pear).

Pyrus sp. (Wild variety of Pear).

Distinguishing characters.—A medium-sized blackish Aphid, with a darker streak on the abdomen; young slate-coloured; cornicles and cauda black; usually apterous females only, having the spur smaller than article III. Cubitus in alate female forked once; sensoria on both articles III and IV; the colonies remain inside the pseudogalls formed by conduplicating young *Pyrus* leaves.

DESCRIPTION.

Apterous viviparous female.—Body ovalish, tapering towards both ends from the cornicular region; pruinose, owing to the white meal; the latero-dorsal parts of the abdomen dark greyish; a dark line runs lengthwise in the middle; last antennal joints, head, cornicles, cauda, anal plate, coxae, distal femora, tarsi, all black; basal antennae, proximal femora and tibiae whitish, or yellowish; eyes dark red.

Head much broader than long; frontal tubercles distinct, small, on the same level as the convexity of the front.

Antennae a little smaller than body; the size varies; article III is longer than the spur.

Proportions of articles :—

	III.	IV.	V.	VI.
	27	17	12½	6+22
Lengths ..	0.45	0.28	0.20	0.10+0.36 mm.

Thoracic segments in stout individuals ill-defined, lateral tubercles present on prothorax.

Abdomen uniform; rows of spots in lateral grooves; posterior two segments banded across; last one with a darker stripe; lateral tubercles on all the segments.¹

Cornicles long, cylindrical, imbricate, slightly broader at base; they reach to the base of the cauda and are directed backwards and inwards.

Cauda ensiform, apical part dark, oval with a few hairs; basal part broad, hyaline, black on edges, less than half the length of the cornicles.

Anal plate rectangular, when seen from below situated a little lower than the genital plate and overlapped by it. The latter appears as if made up of two rounded halves.

Rudimentary gonapophyses three.

Rostrum reaches almost to the second coxae.

Measurements on an average :—

Body	..	..	..	1.90 × 0.95 mm.
Antennae	..	..	..	1.50 mm.
Cornicle	..	..	..	0.33 ,,
Cauda	...	..	..	0.15 ,,

Alate viviparous female.—Colour dark grey or black; very little meal on body. Head black, without frontal tubercles. Eyes dark red. Antennae long.

Proportions :—

	III.	IV.	V.	VI.
	22	13	12	6+30
Lengths ..	0.36	0.21	0.20	0.10+0.50 mm.

Prothorax with a black band anteriorly, in the middle of which on either side is a lateral tubercle; near the posterior angles again another pair which is larger but not so black.

Mesothorax usual shining black.

Wings broad; veins and stigma brown; posterior border of latter darker; cubitus only forked once; anterior limb of the fork longer.

Abdomen pyriform; the pattern consists only of large carinal spots on the second, third and fourth segments; those on the first and fifth are smaller. Immediately behind the cornicles a large rectangular blotch; the seventh and eighth segments are black-banded; transverse, almost linear spots in latero-dorsal grooves.

Lateral tubercles alternate with the carinal spots.

¹ [Very likely this statement is incorrect. As far as I know all *Toxoptera* species only show lateral tubercles on the first and on the seventh abdominal segments. P. v. d. G.].

Cornicles cylindrical, imbricated for the most part.

Cauda small, constricted a little about the middle, ensiform.

Anal and genital plates distinct, the latter elliptic.

Legs normal, black, excepting bases of femora and tibiae.

Rostrum short, extending half way between first and second coxae.

Size of individuals variable ; autumn migrants are larger than the alate females of the summer.

Measurements on an average :—

Body	1.60 to 1.75 × 0.65 to 0.75 mm.
Antennae	1.50 mm.
Wing expanse	5.85—6.20 mm.
Cornicle	0.26 mm.
Cauda	0.10 „

Alate male.—The alate male is essentially quite similar to the alate female described above ; the colour alone is darker ; the size smaller or larger ; the pattern exactly the same.

Antennae longer with a very large number of sensoria.

Antennal proportions :—

	III.	IV	V	VI.
	22	17	16	6+32
Lengths	0.36	0.28	0.26	0.10+0.53 mm.

Sensoria scattered all round the articles, 32–40 on III, about 20 on IV and about 15 on V

Cauda raised upwards owing to the presence of the large genital armature ; it is slightly smaller than that of the alate female.

Anal plate narrow ; genitalia of usual form.

Measurements :—

Body	1.55 × 0.70 mm.
Antennae	1.65 mm.
Wing expanse	5.75 „
Cornicle	0.25 „
Cauda	0.09 „

Oviparous female.—Specimens reared on plums are dirty reddish-brown in colour ; body oval, with short legs ; they move with an awkward gait. The antennae, cornicles and cauda are all smaller than those of the apterous viviparous female.

The frontal tubercles on the head are hardly present.

Antennal joints indistinct ; spur much longer than article III.

Proportions :—

	III.	IV	V	VI.
	13	9	8½	5+20
Lengths	0.21	0.15	0.14	0.08+0.34 mm.

Cornicles very small, cylindrical, black.

Cauda round, on which the usual constriction is faintly marked; more than half the length of the cornicles.

Genital plate much in advance of the anal.

Legs short; tarsi, "ankles" and "knees" black, the rest brownish.

Hind tibiae stunted and swollen in the middle, both ends narrow; there is a comparatively small number of indistinct sensoria scattered over the central dark portion; the ratio of its length to the hind tibiae of an apterous viviparous female is about 7 to 11, as shown in the diagram. The sensoria mostly have a single contour, they number about fifty.

Rostrum reaches beyond second coxae.

Measurements :—

Body	1.20 × 0.70 mm.
Antennae	1.05 mm.
Cornicle	0.14 ,,
Cauda	0.09 ,,

Eggs shining black, lighter when first laid; about .5 mm. or less in length. They can just be made out as dark specks with the naked eye.

Life-history.—The leafy 'spurs' of the pear begin to unfold after the second week of February; the flowers are out a little earlier. The foliage period runs into March. The eggs of this Aphid hatch about this time and begin to attack the young developing leaves. As the leaves are expanding, the presence of one or more of the "stem-mothers" so modifies the process that the two edges of the leaf remain adhering to each other, and do not separate even when it is quite mature. Thus an inflated kind of pod results inside of which the Aphids multiply quickly. Such pseudogalls are generally open near the ends, and one often sees sometimes every leaf on a young branch affected in this manner.

Many generations of purely apterous females are produced, and it is very difficult in the following months of March and April to secure the alate females. Even for dispersing the colonies it is the apterous ones that move out for considerable distances.

In May the last generation become winged, if they are not already destroyed by numerous predaceous and parasitic insects. Every individual on getting wings flies off and does not breed any more on the pear. It has not been possible so far to trace to what host the winged females migrate; by the middle of May the leaves of the pear not yielding any nutrient sap the insects desert them altogether. Empty pseudogalls contain only their exuviae and serve as hiding places for spiders and Coccinellids.

The females ("spring migrants") that have flown off are rather delicate insects, smaller in size than the apterous viviparous females.

From May to December their history is obscure. In early December, or even before, alate females ("return migrants") accompanied by alate males return to the pear or plum. The lower branches of the larger trees and the tops of open nursery plants are chosen for alighting.

The "return migrants" possess powerful wings and larger bodies than the spring migrants. The number of sensoria on the antennae is also greater.

The progeny of these develop into oviparous females, while the males wait till they are ripe. After fertilisation, or if no males are available even without it, one or two eggs are laid by each egg-bearing female. This takes place in the latter part of December or in January. These are the eggs that hatch in February and March to start fresh colonies.

Although sometimes rather badly attacked the pear being a large tree with plenty of foliage does not suffer much by the attacks of this *Toxoptera*. In some cases, moreover, if the Aphids leave off a little early the leaves straighten out again, but generally they remain more or less conduplicated till they fall.

Toxoptera is a small genus, comprising about half a dozen known species from different parts of the world. None has been recorded so far as affecting pears and plums in this way. I believe the species to be new and have named it *punjabipyri* after its chief host in the Punjab.

Genus *Aphis* (Linn.; Mordw.; van der Goot).

In the plains I have come across only about ten species belonging to this genus.

A.—General colour yellow.

- (1) Body deep rich yellow; eyes, cornicles, cauda and anal plate conspicuous black. 9–12 sensoria in a line on article III.

Host *Calotropis* and other *Asclepidaceae*.

A. nerii (Boyer).

- (2) Lemon yellow to greenish-yellow intermingled, others quite green; cornicles and cauda black; 4 or 5 to 7 or 8 sensoria on article III.

Hosts numerous, chiefly *Malvaceae*, *Cucurbitaceae*, *Solanaceae* or any other plants.

Malviform group.

- (3) Light or almond yellow; cornicles small and dusky. Sensoria 9–12, scattered all round; wings with deeply-marked veins.

Host *Sorghum* or *Panicum* sp.

A. sacchari (Zehnt.).

B.—General colour dark pink.

Host *Sorghum* and *Panicum*.

A. sacchari (Zehnt.). Pink variety.

C.—General colour green.

- (4) Bluish green to light greenish. Body elongated; small, black cornicles surrounded by dark areas at base. Sensoria 15–18 on article III, 4–5 on IV. Infests rolled-up leaves of Graminous plants like wheat, maize, sorghum, etc. *A. maidis* (Fitch).

- (5) Body dark or dull greenish; may be mottled, intermingled with yellow. Hosts numerous. Malviform group.

- (6) Body of apterous female oval, uniform, livid green with concolorous cornicles and cauda; 7–10 sensoria on article III, 0–4 on IV.

Host *Nasturtii* sp. (a cruciferous weed near water-courses). *A. nasturtii* (Kalt.) ?

D.—General colour black.

- (7) Body dull black to dark greenish; post-cornicular segments striped; 15–18 sensoria on article III; forms pseudo-galls on leaves, etc.

Host *Solanum nigrum*, *Rumex* and *Cnicus*.

A. rumicis, Linn.

- (8) Body in adult apterous female with a large shining black spot on back; 5–6 sensoria on article III.

Host mostly Leguminous plants.

A. medicaginis, Koch.

A table for the "Malviform Group" of *Aphis* spp. and short accounts of those mentioned above are given below separately. A list of the plants on which they have been collected is incorporated with the general host index at the end of the paper.

Aphis rumicis, L.

Aphis rumicis is a cosmopolitan species and said to be a very general feeder in the West. Numerous writers have mentioned it from a host of plants since Linnaeus first described it in *Syst. Nat.* p. 734. Schouteden gives a list of eleven synonyms (*Cat. Aphids de Belgique*, p. 277, 1906). Buckton has furnished a very good colour description with a plate (*Brit. Aph.*, vol. II, pl. lxiv). Oestlund gives the antennal structure and measurements (*Aphid. Minn.*, p. 61, 1887). Gillette has figured the cornicle and antennae of the alate female (*Jour. Econ. Entom.*, vol. III, p. 407, 1910). Patch illustrates the antennae of a variant specimen with a few notes (*Maine Agric. Expt. Station Bull.* No. 202, 1912).

There is little difficulty in recognising this insect as it infests only a few plants in the Indian plains, and on almost all of them the leaves are turned into pseudo-galls. The most favourite host is *Solanum nigrum*, on which it is shown in the accompanying plate; others are *Cnicus arvensis*, *Rumex dentata*, *Chenopodium* (rarely), *Pyrus communis*.

The species is present almost throughout the year, but is most abundant in the winter months; when it is scarce in the plains, during May and June, it can be collected from the sub-hilly districts.

This plant-louse is very extensively parasitised by one of the Proctropidae; small *Scymnus* beetles also search them out from their shelters; ants invariably attend them.

Aphis medicaginis, Koch.

Literature :—

Koch, *Pflanzenlause*, p. 94, figs. 125, 126 (1857).

Gillete, *Journ. Econ. Entom.*, vol. I, pp. 177-178 (1908).

Essig, *Pom. Coll. Jour. Entom.*, vol. III, no. 3, p. 527, 1911 (gives description and bibliography).

Hosts.—Mostly Leguminous plants, rarely other plants.

Distinguishing characters.—Colour of apterous female warm reddish-brown; the adults shine like glass beads among the droves of dull-coloured young and immature specimens; the basal antennae and tibiae and proximal femora are white and contrast noticeably with the other black parts of these organs. The shining part on the back of the adult wingless female is constituted by a huge irregular black blotch that covers practically the whole of the abdomen, excepting the anterior one or two segments. The alate female has intersegmental black stripes as shown in the figure; there are only five or six sensoria on the 3rd article; cornicles and cauda black.

The insect, though readily recognisable from the above description, has on several occasions been confused with *A. rumicis*, L. and *A. cardui*, L. These two plant-lice, as listed in Lefroy's *Indian Insect Life*, p. 747, from Leguminous plants, are in all likelihood *A. medicaginis*. The "Indigo Aphis" referred to in *Indian Museum Notes*, vol. VI, p. 45, is also evidently this insect.

The size is very variable; ill-fed specimens from Indigo or *Cajanus* may be half the size of others fed on the juicy creepers of *Dolichos*.

The species may be noticed sparingly practically all the year round. Numerous Leguminous plants serve as its host; the names of the plants with dates are given in the host-index at the end of the paper. Those most common are the species of *Cajanus*, *Indigofera*, *Dolichos*, *Dalbergia*, *Medicago*, *Vicia*, *Sesbania*, *Cassia*, etc.

The adult apterous females have the curious habit of falling from the twig or leaf at the slightest alarm. Nothing is known about the life-history or whether the sexes are ever formed or not.

Systematic.—The original description by Koch (*loc. cit.* p. 94) is not very clear; neither does his plate (fig. 126) give a satisfactory picture of the apterous insect; it rather shows two rows of dorso-lateral black spots alternating with white ones, and two or three dark bands on the hind body-segments. Koch evidently did not notice any large polished black blotch on the dorsum, as he was always particular to illustrate such a character, and has done so in several other instances.

There may therefore be some justification for the suspicion in the minds of certain writers that Koch probably was only redescribing *A. rumicis*, L., from a Leguminous plant, under a new name. *A. rumicis*, L. does infest such plants in Europe, but not to my knowledge in India. It is possible, therefore, that *A. medicaginis* (Koch) may turn out to be a synonym of *A. rumicis* (Linn.). But in America all the aphidologists have taken *A. medicaginis* (Koch) to represent the species described above, which is clearly distinct from *A. rumicis*.

If, in reality, Koch's name is proved to be a synonym, then this Aphid (left without a name) will have to be renamed, and *A. papilionacearum* as proposed by van der Goot is very appropriate indeed.

***Aphis nerii* (Boyer de Fonscolombe).**

Synonym.—*Myzus nerii* (Boyer).

Literature :—

- (1) Fonscolombe, *Ann. Soc. Ent. Fr.*, X, p. 157.
- (2) Essig, *Pom. Coll. Jour. Ent.*, III, 3, p. 530.
- (3) Lefroy, *Ind. Ins. Life*, p. 748.

Distinguishing marks.—This species is known in the country as “Ak ka tela,” and can be recognised very readily by the deep rich yellow colour of its body, on which stand out conspicuously the beautiful large black cornicles. It is often seen clustering along the veins of leaves of *Calotropis gigantea* (Vern. Ak). The branches and lower leaves get smeared with the sweet oily-looking excreta which attracts numerous ants, flies and wasps. In bad attacks the plants look very sickly, and the leaves are smutted with a sooty fungus, *Capnodium*.

As the species has been fairly well described in the first two references above, no further account of it is given here. The Punjab insect is apparently exactly the same as the European and the American forms, only it never infests *Nerium odorum*, from which host it takes its specific name. This plant, though abundant, is practically immune from Aphid attack of any kind,

Distribution.—The species is practically cosmopolitan as I have heard of its occurrence in Java, while from the plains as well as the hills of India, specially from the North, the East and the West, it has been collected by myself.

The food-plants are the following :—

- (1) *Calotropis gigantea*.
- (2) *C. procera*.
- (3) *Hoya longifolia*.
- (4) *Cryptostegia grandiflora*.
- (5) *Asclepias* sp.
- (6) *Cynanchum dalhousie*.
- (7) *Dragea volubilis*.

All the plants belong to the Natural Order Asclepiadaceae.

It has been found practically throughout the year on all the plants mentioned above.

Dragea, in May, sometimes has all its flower-stalks thickly covered over with the insect. It is present again on *Hoya* in September and October, and December to February, and in summer on *Calotropis gigantea*.

Systematic.—In Europe the species has been often referred to as *Myzus nerii* (Boyer), but as it has none of the characters of *Myzus* as the genus is at present understood, it should be, and now is, rightly called *Aphis nerii*. The name *Myzus nerii* has been published in *Indian Insect Life* on the identification of Schouteden. *A. asclepiadis* of Passerini is the same insect, but the name *nerii* is older, and a correspondent has suggested that it might better go under that name, as *Aphis nerii* (Kalt.) is still older and a distinct species. But there is some confusion here in the synonymy, and the American authors give the description of *A. asclepiadis*, which is certainly a distinct species.

A. lutescens, Monell, attacks *Calotropis* and the Asclepiads, but this again, in spite of the name referring to the yellow colour, is entirely a distinct insect. Essig has given a description of this insect from California in *Pom. Coll. Journ. Ent.*, vol. III, p. 402.

I think it is best to call it *A. nerii* (Fonsc).¹

¹ [Some doubt has recently been cast on the correctness of calling our Aphid an Asclepiadaceae : *Aphis nerii*, Boyer. The question may briefly be put as follows :—

Passerini (1863) has described a yellow Asclepiad aphid, calling it *Myzus asclepiadis*. Schouteden considered this species to be identical with the yellow Oleander Aphid "*Myzus*" *nerii*, Boyer, and other authors have accepted this opinion. But recently Mr. Theobald has pointed out (*Bull. Ent. Res.*, vol. vi, 1915, p. 129) that in his opinion the Oleander Aphid and the Asclepiad Aphid are two quite distinct species. As the principal point of difference this latter author mentions, that in *Aphis asclepiadis* the 5th antennal joint is shorter than the 4th, while in *Aphis nerii* the 5th joint is said to be as long as the 4th.

This statement, however, is not quite in accordance with the investigations of other authors. Mr. Essig, who furnished a very extensive and apparently correct description of the Oleander Aphid from California (*Journ. Pom. Coll.*, vol. 3, p. 530), mentions that in the apterous female the lengths of the

Natural enemies.—*Chilomeles sexmaculata* and *Coccinella septempunctata* in the larval and imago stage destroy large numbers of this Aphid. All the common Syrphids actively deposit their white eggs among them, and their blind larvae were noticed sucking hundreds of them dry every day. An *Aphidius* is sometimes bred from among colonies of this Aphid but is never abundant.

A curious disease attacks them, possibly of a Fungoid nature, which kills almost all of them at once. The attack seems to be rather sudden, and one might almost unexpectedly find at any time the under sides of leaves full of reddish-brown or later darkish-brown shrivelled-up skins in place of living yellow Aphids. It has often been noticed to appear specially after a very hot day. The heat may have something to do with it, as the outward appearance of the dead specimens is not very different to that of a scorched insect. The Aphids remain attached to the leaves for a long time.

Life-history.—This Aphid can live through the winter in the parthenogenetic state, but probably the sexes are produced before the winter, though none were collected. Every year in February, March and April the leaves and flowers of *Hoya viridis* are covered over with this Aphid in thousands. In September again the case is the same. Any of the above mentioned hosts may be similarly attacked.

***Aphis sacchari* (Zehntner).**

Name and host.—This plant-louse was first noticed on sugar-cane in Java and named after its host (*Arch. Jav. Suiker-industrie*, Dl. IX, p. 674, 1901). The original description is in Dutch.

In India the insect has never so far been collected from *Saccharum officinarum* (sugar-cane), but is here certainly a *Sorghum* Aphis. The only other plant known as its host in this country is *Panicum colore*.

Distinguishing characters.—It is found on the under side of leaves of *Sorghum vulgare* (juar or chari) in thick patches, and excretes "honey-dew" so profusely as to blacken all the leaves. The fungus that forms sooty layers, scales off in thin flakes from the dry leaves.

The insect is almond-yellow or pink in colour with a thick, stout body with small black cornicles; there is a pattern on the abdomen of the alate female, and from ten

antennal articles are : I 0.1 mm., II 0.08 mm., III 0.36 mm., IV 0.28 mm., V 0.25 mm., VI 0.1 mm., VII 0.47 mm. Thus the 5th joint is distinctly shorter than the 4th, exactly as in our Asclepiad Aphis! The difference between *A. nerii* and *A. asclepiadis*, as mentioned by Mr. Theobald, can therefore hardly be correct.

As has already been pointed out by Mr. Das the description of the Oleander Aphis, as given by Essig, agrees fairly well with that of our Asclepiad insect. It remains, however, a very astonishing fact that in tropical regions this aphid should only show a partiality towards Asclepiadae and leave the oleander uninfested. Still more curious is the fact that, after Mr. Theobald, *Aphis asclepiadis* should attack *Salix* too. Only biological experiments will be able to definitively settle whether the Aphids on Asclepiads, oleander and willow are to be regarded as one species or not. Until this question is solved, I think it best to follow Schouteden and call our Asclepiad Aphis *Aphis nerii*, Boyer. P. v. d. G.J.

to twelve somewhat tuberculate sensoria on the 3rd article; cauda subequal or longer than cornicles; the thick smoky veins on the wings are distinctive.

Life-history.—*Sorghum* in Lahore is sown about the latter part of April, and one crop under a system of forced cultivation is ready in July. A second sowing is started about this time. The Aphid makes its appearance on a few low plants, near the margin of the field, early in July. Only small droves of them are visible after a good search. In August and September the attack is in full force. They decrease in numbers soon after this, and some of them shift to *Panicum* spp. Till December the Aphid is in evidence on the latter host. The further life-history remains to be determined.

Biology—This tiny insect possesses extraordinary powers of rapid multiplication. On seedling plants under glass chimneys the new-born young reached the reproductive age after five days, and had moulted four times during this period. At first they bring forth from 3 to 4 young a day, but later the rate slowly decreases. The alate females quickly spread the species to neighbouring plants and frequently considerable portions of large fields are seriously attacked. Such an increase in numbers is correlated with an equally excessive amount of excreta, the "honey-dew" that is voided, falling in small drops over the lower leaves, dries up to a syrupy consistency and offers an excellent medium for the sooty fungus *Capnodium* to grow on.

Blackened and smothered leaves of *Sorghum* are unmistakable signs of the presence of this *Aphis*.

These plant-lice are constantly attended by smaller as well as larger ants. Wasps and flies also hover round the plants.

Enemies.—Besides the usual Coccinellids and a *Lysiphlebus*, there is a tiny Chalcid (*Aphelinus* sp.) that does useful work in reducing its numbers. Aphids stung by *Aphelinus* turn jet black, but do not swell up and are easily recognisable; the parasite on emergence either cuts a circular hole or ruptures the back. Its mode of attack is also unique. The female parasite at first flits from insect to insect examining each with her quivering antennae. On finding one that has not already been stung she retreats a few millimetres, turns round facing away from the victim, and measuring her distance quickly darts out her long ovipositor and thrusts it into the abdomen and deposits an egg. The *Aphis* smarts for a moment and is quiet again. The parasite departs to repeat the process on another specimen. After the second day the *Aphis* changes in colour; at first it is greyish, then darker, and later jet black. The insect adheres fast to the leaf before it dies.

Pink variety.—A dark pink variety of *Aphis sacchari* also exists among the droves, or may be noticed feeding and breeding separately. Excepting in colour there is not the least structural difference between it and the almond-yellow form. A parallel case of this kind is known from Europe in *Macrosiphum rosae*, Linn. The two varieties have an entirely independent life; they breed perfectly true, and the progeny of one is never noticed to develop into adults of the other kind.

The pink variety is never so numerous as the yellow, but in Lahore it is the first to appear on *Sorghum*.

Systematic.—The species doubtfully belongs to the genus *Aphis*, at least it is a very aberrant one. The points of difference are noted below:—

- (1) The antennae in the alate female are about as long as the body, not smaller.
- (2) The cornicles are small, hardly three times as long as broad, not four times or more.
- (3) The cauda is subequal or even longer than the cornicle, not distinctly smaller.
- (4) The wings are clouded with pigment, not hyaline as is usual in *Aphis*.¹

Aphis maidis (Fitch).

Synonyms.—*A. adusta* (Zehnt.)

A. sorghi (Theobald).

Literature:—

- (1) Fitch, *Second Report on the Insects of New York by State Entomologist*, 1856 (original description).
- (2) Oestlund, *Synop. Aphid. Minn.*, 1887, p. 56 (alate insect described).
- (3) Webster, *The Corn-leaf Aphis*. *U. S. Dept. Agri. Circ.* No. 86, 1907.
- (4) Davis, *U. S. Dept. Agri. Bur. Ent. Tech. series*, No. 12 (account of biological studies on this and two more Aphids; mentions full bibliography; a description without figures is also added).
- (5) *Agri. Dept. of India, Pusa, Behar*. A plate under the name of "wheat aphis" has been issued, but is more of popular interest than of any scientific value.
- (6) *Ind. Ins. Life*, p. 747 (identified by Schouteden as *A. adusta* on "juar", *Sorghum vulgare*).

I have not seen good figures of this *Aphis* and therefore have given some, showing morphological details.

Distinguishing characters.—The Wheat Aphis or the Corn-leaf Aphis invariably takes up its position in the half rolled-up young leaves of various graminous crops. It is only on maize and *Panicum colore* (a grass) that it attacks the inflorescence.

The blue-green colour and long oval body, with two black spots surrounding the bases of the short black cornicles, always conspicuous in the light-coloured individuals, are unmistakable marks of its identity.

The alate form is never abundant and is often entirely absent; the structure of the antennae only separates it from another similar species (*Siphocoryne avenae*) on the same crop. The spur of the 6th article is a little over twice the base.

The alate female would often be mistaken in the field for *Siphocoryne avenae*; more so because both migrate to wheat and *Avena* seedlings in November, and are seen as isolated specimens. The black body and head with similar antennae and very short second fork of the cubitus are characters common to both. The number of sensoria on the joints differ, and the spur of the 6th article in *Siphocoryne avenae*

¹ [The writer has placed *Aphis sacchari*, Zehnt. in a new genus called *Longiunguis*, v. d. G.; to this genus belongs another species, *Longiunguis odinae*, v. d. G., which is common in Java and has been collected too in Ceylon by the late Mr. Rutherford. P. v. d. G.]

is about five times that of the base, while in *A. maidis* it is hardly more than double.

Systematic.—The species described as *A. maidis* (Fitch) by Essig (*Pom. Coll. Jour. Ent.*, vol. IV, No. 3, p. 791, 1912) is evidently *Siphocoryne avenae*; hence it is not included in the literature above.

I have also included *A. sorghi* (Theobald) as a synonym of this species. It was reported to attack the leaves and heads of Dura (*Sorghum vulgare* in the Soudan), and an account of the insect appeared in the *First Rep. Wellcome Res. Lab. Khartoum*, 1904. Unfortunately the account is incomplete in certain respects, and the details of structure, on an otherwise excellent plate, are somewhat inaccurate. The total absence of secondary sensoria, as shown on the antennae of the alate female, would be remarkable if it is so. From the colour, form, and the relative lengths of the antennal articles it appears to be identical with *A. maidis* (Fitch), though Prof. Theobald thinks otherwise.

A. adusta of Zehntner, described in 1901, is undoubtedly *A. maidis*, according to van der Goot.¹

Food plants and times of appearance.—In India this Aphid feeds on the following plants :—

(1) Wheat	(<i>Triticum sativum</i>)	December–March.
(2) Oats	(<i>Avena</i>)	November–April.
(3) Barley	(<i>Hordeum vulgare</i>)	January and February.
(4) Maize	(<i>Zea mays</i>)	August–November.
(5) Sorghum	(<i>Sorghum vulgare</i>)	June–October.
(6) Bajra	(<i>Pennisetum typhoides</i>)	September.
(7) „	(<i>Panicum colorense</i>)	September–November and April.
(8) „	(<i>Panicum crus-galli</i>)	March.
(9) Dub grass	(<i>Cynodon dactylon</i>)	December.

In the above months collections have actually been made of this species in the plains, and it is also apparent that it infests both the Rabi and the Kharif crops in the Punjab, and that there is hardly any time of the year when it is not to be met with.

Life-history.—Elaborate experiments were undertaken by Dr. Forbes (*Report of the State Entomologist of Illinois*, 1905, p. 123) to determine the life-cycle in winter at Chicago, and similar experiments were made by Davis (*loc. cit.*) at Urbana, Ill. No sexual forms could be obtained. It appears that in that country it has not been definitely ascertained how the species passes the winter, as its food-plants are not available then. In India there is no difficulty on this account, since some crop is always available, and the insect can pass from one plant to another very easily. Owing to an abundant food supply here one meets with very few winged forms at all

¹ [*Aphis maidis*, Fitch, has been put by the writer into the genus *Siphonaphis*, v. d. G., for the reason that it has distinctly swollen cornicles, together with the presence of lateral tubercles on the first and seventh abdominal segments (see v. d. Goot, *Zur Kenntniss der Blattläuse Java's*, p. 67). P. v. d. G.]

under natural conditions. The few individuals that mature at once fly off to more succulent plants when the ones on which they have been feeding show signs of a decreasing flow of sap. To obtain alate specimens one has often to artificially weaken the plants in confinement, in order to accelerate the production of pupae. Taking two typical plants of summer and winter crops, as wheat and maize, the life-history would ordinarily be alternating on them. *Avena*, I believe, suffers most from its attack, for in the rolled-up young leaves thousands would frequently be found weakening and disfiguring the plants. This position, referred to already above, is very characteristic, and the insect must be responsible for a considerable amount of loss, by retarding growth and not allowing the leaves to open for a long time.

On maize it attacks the male inflorescence from September to November, when it migrates to *Avena* and wheat, which are just sprouting.

Experiments.—In order to determine the course of its life-history in the Punjab, a number of individuals were colonised on *Cynodon dactylon* (common dub-grass) grown in small flower pots, under muslin-topped lamp chimneys. They were kept in the laboratory, the pots being irrigated from below. Some colonies were left in the Botanical Gardens under field conditions, at the place where they were first noticed. The experiments were started early in October, 1913. Throughout the winter, that is up to the middle of January, viviparous reproduction went on, and alate or apterous individuals were formed more or less promiscuously.

The details as to the number of moults, the age at which reproduction commenced and stopped, the days an individual lived, etc., were much the same as those given by J J Davis, and need not be repeated here.

White-banded apterous viviparous female.—Early in February a few apterous viviparous females were observed that were conspicuous among the colonies in the laboratory as well as in the field. Each carried several thick white bands or stripes of mealy powder, one to each body segment. Sometimes the band was discontinuous in the middle, and one or two elliptic spots were in some cases noticed situated latero-dorsally on the immature females, but the full number developed only on adult specimens. These were slightly larger and much darker than ordinary females; the cornicles were distinctly narrowed at the tip.

Measurements of one are given below :—

Antennal proportions :—

	III.	IV	V	VI.
	12	9	8½	5 + 15
Lengths	0.20	0.15	0.14	0.01 + 0.25 mm.
Body		2.50 × 1.15 mm.		
Antennae		0.90 mm.		
Cornicle		0.20 „		
Cauda		0.15 „		

We are not in a position to say positively what is the significance of this “banding”; it has been noticed in *A. rumicis*, and I have also noted it in “malviform”

Aphids in December. Neither was it discovered what kind of individuals the progeny develop into, but with them or a little later, about the third week of February, several winged males were secured in the chimneys, and on *Cynodon* in the garden. As males of this species have never been collected before a short description is given here:

Alate male.—The alate male is a slender, attenuated, shining, dark-reddish, almost black insect; the usual type of genital armature is conspicuous at the anal end.

Head rather broad, quite black, with dark red eyes.

Antennae about the same size as those of the alate viviparous female, but the joints appear thicker, more rounded, and separated from each other by hyaline arthrodial membranes.

Length proportions :—

	III.	IV	V.	VI.
	22	12	10	6+19
Lengths	0.37	0.20	0.16	0.11+0.31 mm.

The spur is only slightly smaller than the base.

Sensoria as is usual in the males; the joints are studded over on all sides by sensoria of various sizes; the 3rd bears about 45, the 4th about 18 and the 5th about 13. None are present on the sixth, except the primary sensorium with its group of smaller ones.

Prothorax distinctly marked by a broad line anteriorly and provided with lateral tubercles.

Mesothorax large, shining black.

Wings normal, on account of the narrow body they appear relatively voluminous; otherwise their actual size is even smaller than those found on larger alate viviparous females. The membrane appears more smoky as a whole; the stigma and veins are brown.

Abdomen long-oval, thin, the breadth here being much smaller than at the thorax. Four large circular spots in front of the cornicles at the carinae, with two or three black stripes on the segments in front of the cauda.

Cornicles cylindrical, with vasiform tip, somewhat incrassate about their middle; the size is smaller than those of the alate female.

Cauda thick, rounded, very much elevated towards the dorsal side, small and stumpy looking; its length is slightly less than the cornicles.

Anal plate narrow, directed backwards.

The genital armature consists of a central conical penis; two spiny lateral somewhat triangular lobes on the sides, meeting in a deep black crescentic line in front. Postero-laterally run two blackish hoops; their hind ends curve to touch the sides of the penis.

Legs long and black.

Rostrum small, reaches half way between first and second coxae.

Measurements :—

Body length	. 1.55—1.65 mm.
Abdominal breadth	0.38—0.42 „
Thoracic breadth	. 0.50—0.54 „
Antennae	1.32 mm.
Cornicle	0.11 „
Cauda	. 0.09 „

The alate viviparous females, produced at the same time when these males form, are unusually large; the dimensions of their wings, body and antennae are all greater than the males. The number of sensoria on article III may be as many as 24; on IV 6-7; some individuals were found with about 5 or 6 sensoria on their 5th article as well.

No oviparous females were collected and are probably never developed on *Cynodon*. Later the size of the apterous and alate females, that were still present on the grass in March, grew extremely small; their colour also was very light greenish.

Life-cycle.—The life-cycle, therefore, after the migration of winged males and females from *Cynodon* in February, is not known. The insect is not noticeable after March. We have again seen apterous viviparous females multiplying actively on *Panicum* sp. in June, in the Botanical Gardens not far from the place where the original colonies existed. These looked remarkably like “stem-mothers” of other Aphids, and in all likelihood had hatched from eggs laid upon these plants some time previously. Therefore, though we have not been able to actually collect either the oviparous females or the eggs, inferentially it seems correct to conclude that after March eggs are laid on species of *Panicum* growing along water-courses. These hibernate in the hot summer months of April and May, hatching in June if there is an early shower of rain.

The point that needs clearing up is, whether the migrant females and males do return to *Panicum*, and whether the progeny of the former develop into oviparous females. From June to March the food-plants are abundant on which the species can conveniently subsist.

Enemies.—Larvae of the smaller kinds of Syrphids destroy whole colonies of this species; several Coccinellids also abound among them.

MALVIFORM GROUP OF *APHIS* SPECIES.

The characters common to the species of this group, besides their extremely polyphagous nature, are:—

- (1) Body more or less oval, from dull or mottled green to lemon-yellow; usually a row of oil globules, coloured yellowish or greenish, between the cornicles.
- (2) Cornicles tapering, black.

- (3) Cauda ensiform, black,¹ bearing very nearly the same ratio in length to the cornicles; that is a little more than its half.
- (4) Pupae in all the species have rows of white spots and develop yellow or orange pigment upon the anterior abdominal segments.
- (5) In alate females the pattern consists of similar lines and spots.

Not only can these species subsist on a great variety of different plants, but their size and colour is also subject to many variations. This is responsible for the considerable amount of confusion that prevails in their synonymy in the West. No satisfactory diagnoses are available, and the same insect has been described by different authors under several names because of the once current idea that each plant had its own peculiar Aphid.

After making extensive collections of these insects in many parts of India I have exchanged them for other Asian, American and European specimens, and have also carried out a number of "pure culture" experiments by isolating single individuals on plants in chimney pots and watching their progeny. As a result of this I am able to distinguish four distinct species recognised by their structure under the microscope, and I believe them to be as follows:—

- (A) Sensoria present on both III and IV antennal articles .. (1) *A. durranti*, sp. nov.
(Isolated on *Durranta* and *Colocasía*).
Sensoria present only on III. (B).
- (B) Spur of VI much longer than III, roughly in the ratio of 3
to 2 (2) *A. malvae* (Koch).
(Isolated on Cucurbitaceae).
Spur of VI slightly longer or subequal to III. (C).
- (C) Sensoria on III, 6–8, not quite in one line; a large species;
antenna more than 1 mm.; cornicles about 20 mm. .. (3) *A. gossypii* (Glover).
(Isolated on Balsam; *Capsella*; *Cryptostegia*, etc.).
- (D) Sensoria on III, 4–6, all in one line; a small insect; antenna
less than 1 mm.; cornicles about 15 mm. or less .. (4) *A. malvoides*, sp. nov.
(Isolated on *Malvestrum*, *Chrysanthemum*, etc.).

***Aphis malvae* (Koch).**

Synonym.—*A. cucurbiti* (Buck.) ? (*Brit. Aph.*, vol. II).

This Aphid we have found chiefly on Cucurbitaceae, but it attacks an extremely large number of other plants as well. The same is said of it in other parts of the world also.

Apterous viviparous female.—They vary in colour from green to lemon-yellow. For some time the progeny of the yellow form remain yellow, but when the colony increases the young often develop into green. The offspring of the green form may similarly be quite yellow.

The green colour begins to invade the abdomen from the cornicular region and

¹ [The cauda is not black in all the species belonging to the malviform group. In *Aphis malvae*, for instance, the colour of the cauda varies from light yellowish to dark green or dusky green, but is never blackish. P. v. d. G.].

extends backwards and forwards; it is due to the internal juices, the skin itself being quite hyaline.

General form of body, cornicles, cauda, etc. are shown in the figures.

The antennae reach to about the base of the cornicles.

Length proportions :—

	III.	IV.	V.	VI.
	17	10	9	6+18
Lengths ..	0.28	0.16	0.15	0.10+0.30 mm.

Measurements :—

Body	..	..	..	1.50 × 0.75 mm.
Antennae	..	..	..	1.12 mm.
Cornicle	..	..	..	0.26 ,,
Cauda	..	..	..	0.14 ,,

The pupa have a green intercornicular band and rows of white spots on the back.

Alate viviparous female.—It is slightly smaller than the apterous female; the cornicles also are comparatively smaller. The pattern on the abdomen is indistinctly marked; on the mid-dorsum of the abdomen three faint spots can be observed on the first three segments, also two bigger stripes on the two posterior segments.

The structure of the antennae is characteristic, although its length varies according to the size of the individual; smaller specimens may be even less than three-fourths of the larger ones.

The antennal articles are long and well marked; all are imbricate.

Length proportions :—

	III.	IV.	V.	VI.
	14	10	9	6+20
Lengths ..	0.25	0.16	0.15	0.10+0.34 mm.

Article III is roughly about two-thirds the length of the spur.

Sensoria circular and rather large, almost in one line; their number usually is six, but varies from five to seven.

Cornicles quite black and smaller than those of the apterous female.

Cauda more than half the cornicle length, as shown in the drawing.

The rostrum reaches to the second pair of coxae.

Lateral tubercles on first and seventh segments well developed, as usual.

Measurements (on an average) :—

Body	..	..	..	1.50 × 0.65 mm.
Antennae	..	..	..	1.10 mm.
Cornicle	..	..	..	0.20 ,,
Cauda	..	..	..	0.11 ,,
Wing expanse	..	..	..	4.85 ,,

The season when it is most abundant is May and June; it badly attacks melons, cucumbers, squashes, gourds and *Lagenaria*, etc.

It is extensively parasitised and preyed upon by numerous predaceous Aphid-enemies.

Systematic.—I have not been able to procure the real *A. cucurbiti* of Buckton from England ; the original description is faulty in several respects, but the coloured figures that he has given seem remarkably like the insect described above. I have therefore kept it as a doubtful synonym of *A. malvae* (Koch). European specimens agree in essential features with it, but Buckton has given in the same volume figures and an account of what he considered as *A. malvae* (Koch). It is likely, therefore, that his *A. cucurbiti* might be different, but only an actual examination of his specimens can settle the point.¹

***Aphis malvoides*, sp. nov**

Hosts.—Numerous, e.g. *Malva* spp.; *Malvestrum* spp.; Chrysanthemum; pear; pansy; *Solanum* spp., etc.

Apterous viviparous female.—A comparatively small insect, but very abundant.

Body oval, lemon-yellow without mottling; between the cornicles usually a row of oil globules that possess a greenish tinge; this tinge in some individuals spreads in front and behind also.

Head well-rounded, greenish-brown with inconspicuous frontal tubercles.

The antennae reach half way down the back; black distally. The spur and article III are almost equal; sometimes III is even slightly longer.

Proportions :—

	III.	IV.	V.	VI.
	12	7	7	5 + 12.
Lengths :.	0.20	0.13	0.13	0.08 + 0.20 mm.

Prothorax concolorous with head.

All the thoracic segments have a pair of black dots, one on each side just above the coxal joints. A dark brown band, which lies to the front and outside each coxa, often invades the lateral sides and thus small smoky patches are visible on the carina even from the dorsal side. The band is largest on the metathorax.

Abdomen pyriform; all the segments bear lateral tubercles, the largest ones are on the first and seventh; white meal is scanty on the dorsal surface.

Cornicles small, jet-black and conical, truncate at tip.

Cauda ensiform, tip dusky; the broader base below the constriction very light-coloured and hyaline; about half the length of the cornicles.

Anal plate rectangular, much blacker than the genital plate, which is more or less rounded.

Legs yellowish, tibial points and tarsi black; in front of third coxae a conspicuous black mark extending outwards.

The rostrum reaches almost to the 3rd pair of legs.

¹ [In my opinion *Aphis cucurbiti*, Buckt., is without doubt identical with *Aphis malvae*, Koch. The species is common in Holland on cucumbers in greenhouses. P. v. d. G.]

Measurements :—

Body	1.20 × 0.50 mm.
Antennae	0.90 mm.
Cornicle	0.25 ,,
Cauda	0.12 ,,

Alate viviparous female.—Body-colour yellow; portions behind the cornicles and at their level full of greenish globules; the posterior part of the abdomen may be quite dark greenish: the usual pattern of three carinal spots; one cornicular and two bands on the last two segments are present.

Head, antennae, thorax, legs, cornicles and caudal tip black.

Antennal proportions :—

	III.	IV	V	VI.
	12	9	7	5½ + 14.
Lengths	0.20	0.15	0.13	0.08 + 0.23 mm.

Sensoria large, circular; they are seldom more than five but may be six or as few as three, generally placed in a line.

Cornicle smaller than that of the apterous female, conical and imbricate; it does not reach to the base of the cauda.

The cauda has the constriction between the base and tip rather ill-defined; it is a little longer than half the cornicle.

Genital plate larger than that of the apterous female, less dark than the anal plate.

The rostrum reaches up to the edge of the mesosternal bosses.

Wings rather small, well-rounded, with brown veins and greenish stigma.

Measurements :—

Body	1.20 × .45 mm.
Antennae	0.90 mm. or less.
Wing expanse	4.20 ,,
Cornicle	0.16 ,,
Cauda	0.10 ,,

The pupae are characteristic, appearing as if constricted between the thorax and abdomen. Anterior half of abdomen bright yellow or even orange; posterior half dark greenish. The head bears two blackish lengthwise marks, between these the skin splits in moulting. Thorax greenish with light green, almost white, shoulders, tipped with jet black. Two median rows of white spots, a pair to each segment, extend from the head to the caudal base; on the abdomen they widen out a little. Parallel to these are placed four similar spots on either lateral edge.

This small Aphid is extremely polyphagous and infests plants of widely different orders. It is not infrequently found feeding in company with other malviform Aphids, and can only be recognized from *A. malvae* or *A. durranti* by the structure of its antennae.

It can be collected almost throughout the year except in the summer.

It is likely that this insect occurs in other parts of the world also, and has been

confused there with *A. malvae* (Koch). But as no account of it appears to exist anywhere I consider it to be an undescribed species. There is a very close affinity between these two plant-lice, and I have consequently named it *Aphis malvoides*, sp. nov.¹

***Aphis durranti*, sp. nov.**

Hosts.—*Durranta* sp.; *Vitex nigrundo*; *Colocasia*, etc.

Apterous viviparous female.—Body of small size, about the same as *A. malvoides*.

Colour yellowish-brown, without any mottling; in fully developed specimens the thorax, edges of the abdomen and the post-cornicular segment are dark green.

Head dark brown, concolorous with the basal antennal joints; front convex.

Eyes dark red.

Antennae on inconspicuous frontal tubercles. The spur is more or less subequal to the 3rd article; sometimes it is smaller and sometimes a little longer.

Proportions :—

	III.	IV	V	VI.
	14	9	8	5 + 14.
Lengths	0.24	0.15	0.14	0.08 + 0.24 mm.

The prothorax bears lateral tubercles and a black stripe.

The mesothorax and metathorax are large; on their lateral sides both are marked by rounded elevations of black pigmentation. This is quite a characteristic feature, and under a high power of the microscope the fine irregular meshwork of lines over the body assumes here the form of more or less circular facets, like those of the wax-glands in some other genera. Each mass of these circular facets looks like a huge gland. Similar but very much smaller facet-groups are to be seen on the abdominal segments as well. Below these groups and in front of the attachment of the leg is situated a strongly developed tubercle.

Abdomen sparingly pruinose; lateral tubercles of first and seventh segments rather small; on others they are absent.

Cornicles long and stout; cylindro-conical, black; they reach to the base of the cauda.

Cauda ensiform, black at apex; there is a slight constriction between the narrow base and oval apex; it is two-thirds the length of the cornicle.

Anal plate black, elliptic.

Genital plate dusky.

Legs normal, with tibial points, tarsi and coxae black; the rest brownish.

Rostrum long; it reaches almost to the third coxae; last joint over one and a half times the one before it.

¹ [The name *Aphis malvoides* is already preoccupied for a greenish Aphid, occurring chiefly on Compositae in Java (see v. d. Goot, *Zur Kenntnis der Blattläuse Java's* p. 96). I would therefore propose changing the name of this little Aphid into *Aphis malvacearum*, nov. nom. I have some doubt that this species may only be a small variety of the polyphagous *Aphis gossypii*, Glov. P. v. d. G.]

Measurements :—

Body	1.50 × 0.65 mm.
Antennae	0.90 mm.
Cornicles	0.26 „
Cauda	0.16 „

Pupae dirty dark green ; the thorax, anterior and posterior parts of the abdomen and also the margins are dark green ; the central dorsum is greenish-brown, much lighter, in some distinctly yellowish ; shoulders dark-tipped.

There are four rows of white tassellations as is usual in other malviform Aphids.

Alate viviparous female.—Prevailing colour of body dark green ; thorax, antennae, legs, cornicles and cauda black.

Head about as long as broad, without any trace of frontal tubercles.

The antennae have the following lengths :—

Proportions :—

	III.	IV	V	VI.
	15	10	9	5 + 16.
Lengths	0.25	0.16	0.15	0.08 + 0.26 mm.

The spur is more or less subequal to the third article.

The articles are well segmented, unlike those of the apterous viviparous female, in which the 3rd and 4th are often confluent.

Sensoria rather small, but usually present on both the 3rd and 4th on one side. They number 6-9 on III and 0 or 1-4 on IV. Only rarely the 4th has one or no sensorium ; two or three are the normal number, with seven or eight on III.

Prothorax banded across anteriorly ; lateral tubercles present.

Muscle bosses of thorax of the usual shining black, with yellowish insertions.

Wings with normal venation ; the brown veins are well marked ; stigma greenish-brown.

Abdomen pyriform, compact ; four black spots on the carina are clearly visible ; the blotch behind the cornicles and the stripes on one or two of the anterior segments and three on the hinder ones are well seen.

Cornicles small, truncate, conical, with a broader base.

Cauda comparatively larger than that of the apterous female ; it is about two-thirds the cornicle or more ; the waist between the base and the apex is obsolete.

Rudimentary gonapophyses three.

The rostrum reaches to about the second pair of coxae.

Measurements (on an average) :—

Body	1.35 × 0.50 mm.
Antennae	1.00 mm.
Wing expanse	4.15 „
Cornicle	0.15 „
Cauda	0.10 „

Aphis durranti can be distinguished with comparative ease from other malviform Aphids, but the differences seen with the naked eye are small, and the size and colour being variable, one cannot readily make it out from *A. malvoides*, sp. nov. or even *A. malvae* (Koch) when the two are feeding together.

As it seems to be an unnamed species, it has been called after its chief host, *Durranta*.

The time of appearance is late in September or October, and it continues on till January or February.

Late in December some females were observed to be banded with a white powdery substance of the same nature as that forming the tassels of the pupae. These white bands have been noticed in the case of other species of *Aphis* as well, but little explanation has been offered in regard to them.

No sexuales were secured, though it is probable that they do form at this season, and in all likelihood the progeny of the white banded females may later be found to have some connection with their production.

Winged males in species of this genus are not very different from alate females, and only a careful examination of the genitalia and antennae reveal the differences. The same is true of the apterous oviparous females whose hind legs are not so much swollen as in the other genera; they develop only a few secondary sensoria which ordinarily would escape observation. This perhaps accounts for the scarcity of true sexes so far obtained in this genus.

The chief parasite of this species is a *Lysiphlebus*; it is sometimes so extraordinarily numerous that about midday one can catch hundreds of them by hand.

***Aphis gossypii* (Glover).**

Synonym.—(1) *A. citruli* (Ashmead), 1882.

(2) *A. cucumeris* (Forbes), 1883.

Hosts.—Cotton; *Capsella*; *Impatiens* sp.; *Cryptostegia grandiflora*, etc.

Literature :—

Glover, *Pat. Off. Report*, p. 62; 1854 (contains original description: reproduced again by Ashmead, *Can. Entom.*, XIV, p. 91, 1882).

Gillette, *Jour. Econ. Entom.*, I, 3, p. 176; 1908 (*A. gossypii* and allies); *id.*, *ibid.*, III, 5, p. 404 (1910).

Essig, *Pom. Coll. Journ. Entom.*, III, 4, p. 590; 1911 (a complete description).

Lefroy, *Ind. Ins. Life*, 1910 (mentioned on cotton).

There are slight differences in the measurements of the Indian form as compared with those given by E. O. Essig for the American insect on *Citrus* species.

This Aphid shows more distinct mottling than others; the pattern on the abdomen of the alate female is made up of larger and clearer black spots and dashes, that is of two or three lines on the anterior abdominal and three stripes on the posterior abdominal segments, besides three precornicular carinal spots and another immediately internal to the cornicles.

Antennae long, black, with slender articles.

Proportions :—

	III.	IV	V	VI.
	17	10	10½	6+18
Lengths	0·28	0·16	0·17	0·10+0·30 mm.

The spur and the 3rd article are subequal.

The sensoria are often placed in pairs, some larger and some smaller, from 6—8 in number, usually 7.

Wings large, with the usual venation ; stigma greenish.

Cornicles black, cylindro-conical, imbricate.

Cauda with a slight constriction about its middle ; base broad, hyaline ; tip dusky.

Measurements :—

Body length	1·50—1·75 mm.
Breadth	0·65—0·75 „
Antennae	1·12 mm.
Cornicle	0·20 „
Cauda	0·12 „
Wing expanse	5·40 „

In the apterous female the spur is always smaller than the third article ; the cornicles about twice the cauda ; sometimes less than that. The cornicles and cauda are much longer than those of the alate female.

Date of collection.—From October to December, also in March and April.

Systematic.—Some doubt has recently been cast in Europe and America as to the distinctiveness of this species. It is supposed that Glovers' *A. gossypii* is only a synonym of *A. malvae* (Koch), but the supposition has never been so far definitely established, and in American literature *A. gossypii* (Glov.) stands as a well-defined species.

There are numerous references to it and Pergande has listed upwards of thirty plants as its host (Riley's *Insect Life*, vol. III, pp. 309-314). It would not be surprising at all if some of these references at least refer to species other than *A. gossypii*, and this may have been the origin for the doubt entertained by some writers.

That the species is, however, a perfectly distinct one can be shown by its morphological characters as is clear also from the table given above (p. 213).¹

Aphis nasturtii (Kalt. ?).

Host.—*Nasturtium* sp. (*N. indicum* ?), found in moist places along the margins of ditches and water-courses.

¹ [M. Das has in a clear and distinct way succeeded in separating *Aphis gossypii*, Glov., from allied forms, such as *A. malvae*, Koch. His work will definitely extinguish the confusion, which until now has reigned on this subject. P. v. d. G.].

Literature :—

Kaltenbach, *Pflanzenl.*, 1843, p. 76.

Koch, *Pflanzenl.*, 1857, p. 136, fig. 125.

Schouteden, *Cat. Aph. Belg.*, 1906, p. 224.

Distinguishing characters.—The apterous female is wholly grass-green, including the legs and cauda as well as the proximal halves of the antennae and cornicles. The alate female is green with thick-veined wings and sensoria on articles III and IV. It is found on *Nasturtium* sp., a cruciferous weed, in March and April.

I believe that the Punjab insect is identical with the European one which is known to me only from published descriptions. The structural details of the latter are not available, but those noticed in the former are given below:—

Apterous viviparous female.—Body of medium size, scantily pruinose, rather stout, ovalish in form.

Colour grass-green, bright; legs, rostrum, antennae except the sixth article, main part of cornicle, cauda, ventral surface similar in colour; tarsi black; eyes blackish-red.

Head twice as broad as long; small frontal tubercles present; prominently knobbed in front.

Antennae about two-thirds of the body-length; the articles indistinctly separated, sparingly hairy.

Proportions :—

	III.	IV.	V	VI.
	16	11	9½	6+18
Lengths .	0·26	0·19	0·17	0·10+0·30 mm.

There are lateral tubercles on the prothorax and first and seventh abdominal segments.

Abdomen smooth, with rows of very fine hairs on the segments.

Cornicles for the most part greenish, specially near the base; distally smoky, in old specimens they may be altogether dusky; cylindro-conical, truncate, smooth without any imbrications, curved outwards.

Cauda somewhat conical; apex thick and rounded, two-thirds as broad as the base.

Anal plate rectangular; genital lighter in colour and band-like.

Rudimentary gonapophyses three.

Legs short; tarsi black; sole pustules well marked on the tibial points.

Rostrum long, black tipped; it reaches almost to the third coxae.

Measurements :—

Body length	1·60—1·70 mm.
Breadth	0·95—1·00 ,,
Antennae	1·10 mm.
Cornicle	0·30 ,,
Cauda	0·19 ,,

Alate viviparous female.—Body more compact, oval in form.

Colour leaf-green; head, a band on prothorax and mesothorax, cornicles and caudal apex black; coxae, distal parts of femora and tibiae, anal and genital plates dark brown; the rest of the legs greenish-yellow; eyes dark red.

Head a little broader than long.

Antennal articles imbricate, separated by hyaline constrictions.

Proportions :—

	III.	IV.	V.	VI.
	18	12	10	6+19
Lengths ..	0.30	0.20	0.17	0.10+0.31 mm.

The spur is slightly longer than article III and may be even only as long as .26 mm.

The prothorax has two latero-dorsal pits and tubercles on the sides.

Mesothorax with strong muscle-bosses and greenish insertions.

Wings ample, with deeply marked veins; stigmal flattening yellowish, its posterior border and the rest up to the base greenish; venation normal.

Abdomen pyriform, with lateral tubercles; the pattern consists only of three spots on carinae in front of the cornicles and one more just behind and internal to them; the rest is uniformly green.

The cornicles and cauda are smaller than those of the apterous female; cornicles imbricate and longer than the cauda in the ratio of 10 to 8; base of cauda greenish, bordered with black.

The rostrum reaches to the second coxae.

Measurements :—

Length	..	..	..	1.50—1.70 mm.
Breadth	..	..	..	0.70—0.85 ,,
Antennae	..	..	..	1.00—1.20 ,,
Wing expanse	..	..	..	4.60—6.00 ,,
Cornicle	..	..	..	0.16—0.21 ,,
Cauda	..	..	..	0.11—0.15 ,,

The insect has been collected only during the months of March and April and even then it is not very abundant. Its appearance is somewhat capricious and its disappearance is equally sudden.

Nothing is known as to its history during the rest of the year.

***Brachycaudus pruni* (Koch) (van der Goot).**

(=*Aphis pruni*, Koch.).

“Peach-curl Aphis.”

Hosts (in the plains) :—

(1) Peach (*Prunus persicae*).

(2) *Ageratum conyzoides*.

Literature :—

Koch, *Die Pflanzenläuse*.

Buckton, *Monogr. Brit. Aph.*, II, p. 64.

van der Goot, *Zur Systematik der Aphiden*, pp. 96-97.

Stebbing, *Ind. Mus. Notes*, VI, 1913, p. 70 (only referred to as *Aphis* sp. from Dehra Dun).

Distinguishing marks.—This Aphid, so destructive to peaches in Northern India, may be at once recognised by its mode of attack in badly twisting and curling the leaves, in the folds of which it lies well protected and reproduces extensively. It exudes large quantities of sticky "honey-dew," which dries up in the form of a thin pallicle on the inside of the leaf ("pseudogalls") and scales off when the leaf is broken open.

The species is a small yellowish-green insect with one or more darker green stripes on the back; the cornicles are black, specially near the tip; the cauda is hardly visible from above, where there are prominent hairs; the winged females have a large black blotch on the back, accompanied by three or four large black spots on the lateral sides.

The camera lucida drawings show the morphological characters fairly well; the colour and accounts of the size of this insect will be found, given quite correctly, by several European authors.

Brachycaudus pruni resembles in several particulars another peach-infesting Aphid, known in America as the "Green Peach-Aphis" *Myzus persicae*, Schrank (= *Rhopalosiphum dianthi*, Sulz.).

Both are of a similar colour in the body and have a tendency to turn pink; the pupae have three dorsal stripes on the back and the alate females in both are furnished with a big blotch on the abdomen. As the two are frequently found together on the same plant one might easily confuse one with the other.

The following points would differentiate the two with readiness:—

Myzus persicae have larger bodies and longer antennae and legs; the antennae are placed on frontal tubercles which are large and produced into a rounded process towards the inside; the prominent cauda and clavate cornicles are besides further characters not found in the "Peach-curl Aphis," in which the antennae are implanted directly over the head without any frontal tubercles between them.

Appearance.—This Aphid is one of the worst insect-pests that the peach-growers have to contend against throughout Northern India. The leaves are so badly twisted and contorted into pseudogalls and the trees rendered so sickly and unsightly, that they can be recognised at a glance even from a distance. The leaves appear closely crowded and never expand fully; they turn whitish and in some cases pinkish in colour.

Pseudogalls.—The insects sit on the under sides of the leaves along the veins, with their beaks inserted into the growing cells of the vascular tissue. They appropriate all the nourishment that comes to the leaf and thus arrest its growth, particularly in the length. The portions of the membrane or lamina that are free to grow are those enclosed between the veins, so that in their growth they arch outwards and

form pouched convexities, under the shelter of which the insects multiply rapidly. There is an increased flow of plant juices towards the points of irritation caused by the presence of the beaks of the insects, and often later there is a good deal of hypertrophy in these parts which retain their original direction of growth. This results in the formation of the noticeable pseudogalls which are sometimes almost quite closed.

Loss of fruit.—The drain on the plant is very excessive and the normal functions of the foliage are much interfered with; naturally, therefore, the other parts of the plant and in particular the growing fruit are not supplied with sufficient quantities of nutrient fluids. They either are what the gardeners term “thin,” that is dwarfish and sickly, or fall off after attaining a small size.

Sometimes whole orchards are affected and the annual loss to peaches must be very considerable. As any further consideration on this head would perhaps be foreign to the scope of this paper, the nature and extent of the loss or its prevention is not touched upon here. For information of this kind one can refer to some excellent Reports and Bulletins issued from the Agricultural Experiment Stations in various parts of the United States of America. Some of the most recent are:—

Monthly Bulletins, State Commission of Horticulture (California), 1913, by Essig.

Biennial Report of Crop and Horticultural Pests 1913: On Aphid Control by Wilson.

Bulletins of Maine Exp. Station by Patch.

Natural enemies.—In spite of its sheltered position this Aphid is extensively parasitised by a *Lysiphlebus* sp. It has often happened that if a twig has been brought from outside enclosed in a handkerchief and kept a few days under cover, one finds at the end of this period hardly any Aphids but plenty of swarming parasites. Several species of Syrphids, chiefly the smaller kinds, lay their eggs near them and the larvae from these suck the Aphids dry. Of the Coccinellids the most useful are three species of *Scymnus*, their small size giving them an easy entrance into the pseudogalls; *Chilomeles sexmaculata* and *Adonia variegata* as well as *Coccinella 2-punctata* are often noticeable, while *Brumus suturalis* is as good as any *Scymnus*.

Besides the above Stebbing has mentioned *Collophora sauzreti* on Peach Aphis (*Ind. Mus. Notes*, VI, p. 45).

Life-history.—The leafy spurs of peaches begin to sprout in the latter part of February or in early March. The Aphid also makes its appearance about this time and begins to curl them up. It is probable that in India, as in other countries, the stem-mothers hatch from eggs laid on peaches some time previously, and it is these that start future colonies; the winged generations soon appear and disperse the species to other plants. Throughout April and some part of May, and in moist shady places even up to June, the Aphids are numerous on peaches.

At this time they may also be noticed on a compositous weed, growing along ditches and water-courses (sometimes cultivated also), causing similar curls on the

leaves. On this plant (*Ageratum conyzoides*) they remain throughout the rains and may be collected even up to August.

The case is the same in the hills where they are present up to August on several species of *Prunus*, particularly *P. padus*.

It is on record for the European form that alate males and oviparous females are produced in November. The latter after mating deposit eggs which remain dormant throughout the winter and hatch again in the spring. Such a course is probably taken by this Aphid in the hills in India but not in the plains. I have never observed it on any species of *Prunus* or *Ageratum* after September. It is very likely that the males and females are produced before the end of summer and these lay eggs which hatch again in March, but nothing can be definitely said until further investigation.

The alternate host *Ageratum* might possibly send back the "return migrants" to peaches, which may give birth to males and females in autumn, but in the absence of definite data nothing can be concluded. There is scope here for further work that would amply repay the labour involved as the insect is of very great economic importance. Any methods of control would entirely depend upon a fuller knowledge of its life-history.

Early application, before the leaves are fully out, of some good spray of kerosine emulsion or tobacco decoction is what seems to be practised in America for such pests.

Systematic.—So far the insect has been referred to in current literature as "*Aphis pruni*," but it seems anomalous to group this species along with *A. rumicis* or *A. gossypii*, etc., in the same genus. Several important characters, among others the peculiar form of the cauda and the anal end as well as the absence of lateral tubercles on the seventh abdominal segment, differentiate this species from the true genus *Aphis*. Mr. van der Goot, in his proposed revision of the subfamily Aphidinae, includes this species along with a few more in his new genus *Brachycaudus*. I am in entire agreement with him on this point and have accordingly adopted his name. According to him we should further consider *A. helichrysi* (Kalt.) as a synonym of this species, and as the former was employed at an earlier date the name *Brach. helichrysi* should have priority.

Since writing the above, I have secured males and true females of this Aphid in December on peaches, along with the males of *Myzus persicae*. So the life-history here is practically the same as in the West. The males are very similar to the alate females except that the antennae have sensoria on all the joints and the anal end is provided with the genital armature.

***Hyalopterus pruni* (Fabr.).**

(Mealy Aphis of Peach and Reed).

Synonym.—*H. arundinis* (Fabr.).

Hosts.—*Arundo donax* (Vern. Nara).

Phragmites kirki.

Prunus persicae (Peach).

Literature :—

Buckton, *Brit. Aph.*, II, p. 110.

Riley, *Insect Life*, V, p. 236.

Gillette, *Bull. Color. Exp. Station*, No. 133, 1908.

Fabricius, Koch, Mordwilko, van der Goot and others.

Distinguishing characters.—Body somewhat linear, green; four rows of white powdery spots on back; very small cornicles; long cauda; spur and 3rd article subequal; the insect crowds closely in an overlapping manner on the leaves, plentifully surrounded by white mealy secretion and much appressed to the leaf surface, on peaches and *Arundo*, etc.

Systematic.—As noted above this insect has for its host two plants of entirely different orders, peach in gardens and *Arundo* or *Phragmites* near the water's edge. *Arundo* is pretty commonly grown as a hedge in Lahore, but the Aphid attacks it only on the river-side or along the banks of the Chhota Ravi.

The specimens developed on peaches occasionally differ in some minor details from those on *Arundo*, but in essential structure they are exactly similar. Fabricius, the author of the species, believed them to be distinct from each other, and accordingly named one *Hyalopterus pruni* and the other *H. arundinis*. Koch, Buckton and many others held similar views, but it has been definitely established by Riley and Mordwilko that the two are the same species with two distinct-hosts. When the two plants occur in the same locality this fact can be easily observed.

The specific name *pruni*, as referring to the more important of the two hosts, is more commonly employed than *arundinis*, though the latter is also in use.

Life-cycle.—The course of its life-history has been followed in Lahore for more than two years and is, in the main, very much the same as what obtains in Europe and America.

Peaches, specially the young plants, put forth new leaves twice a year, once in March and again in September. At both these times thick clusters of the insect may be found crowding chiefly on the under side of the leaves. These hatch from eggs and from March to early in May several generations of apterous females are produced. After this peaches are entirely deserted, although the winged forms that are produced even earlier migrate to *Arundo* or *Phragmites*. They do not remain even on these plants for any length of time. In the summer months they are exceedingly scarce, but are in evidence again in September.

Throughout October alate females come to *Arundo* and start new colonies. The female first makes a white circle of meal, shed from its body, and spreads it evenly on the upper surface of the leaf. As long as the brood consists of only a few young, the circular form of the white patch is maintained by the mother spinning round upon its beak. The waxy secretion adheres tenaciously to the leaf long after all the insects have left. If a drop of water or honey-dew happens to fall on the Aphids it at once becomes a white globule and rolls off without wetting their bodies. During October, November and even December apterous and alate females are produced that attack both surfaces of the leaves. About the middle of December the alate males and

the alate females return to young peaches that still have succulent leaves. These specimens either come from other peach trees or from *Arundo*, but mostly from the latter.

The alate females known as "return migrants" are considerably larger than the ordinary winged ones, and more so than those found on peaches early in the season. The wing expanse may be as much as 7.35 mm. The sensoria on the long antennae also number more. After once settling on the leaf the insects are not inclined to move. Below and on the lateral sides of their abdomen thick masses of waxy secretion accumulate and have a silky appearance. The mass seems to be composed of accicular crystals. The quiescent insect, with a white mass below and on either side of the anal end, looks as if attacked by a fungus. The progeny of these are yellowish and soon develop into oviparous females.

These egg-bearing females begin to lay eggs near the buds about the end of December and continue doing so into January or even into February. The males usually die in December. The eggs normally hatch in March.

It would be of interest to know if some of the eggs laid in December or later remain dormant till September; the insects that cluster on peaches at this time look very much like "stem-mothers" in their form and rate of reproduction.

The parthenogenetic reproduction continues throughout winter and even up to March, on *Phragmites*; so that it is only a few of them that give birth to "males" and "return migrants" that go back to peaches, the others remain behind. Sexual individuals have been collected so far only in December and January.

Excretion of honey-dew is extremely abundant in this species; numerous ants, bees, wasps, flies, etc., flock to such infested plants. Predaceous insects and parasites are also numerous. The leaves of peaches, usually on the topmost branches, when attacked by this Aphid do not attain their normal size and colour, but remain small and greenish-yellow in colour.

Brachyunguis, gen. nov.

Characters of the genus.—Body oval, small to medium sized, clothed with mealy pulverescence.

Head totally devoid of frontal tubercles.

Antennae short, third article the longest; the spur or "unguis" of the sixth joint very small, about half as long as the base. (The generic name refers to this character).

Lateral tubercles present on the first and seventh abdominal segments.

Cornicles small, almost cylindrical, half as wide as long.

Cauda well developed, broad-based and long conical; about twice the length of the cornicles.

Rudimentary gonapophyses three.

Three species are found in Lahore belonging to this genus. All are apparently new to science, and accounts of them are given below. Among foreign Aphids none seem to have been recorded as possessing these characters.

Brachyunguis harmalae, sp. nov.

Vern. "Harmal ka Tela."

Host.—Harmal (*Peganum harmala*).

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body medium sized, about a millimetre and a half in length, oval or egg-round; fairly thickly covered with white powder.

Colour green, like that of the leaves of its host; deep green from the prothorax to the first two or three abdominal segments; afterwards it becomes gradually lighter, and about the cornicles and behind them it is almost yellowish, with a very slight tinge of green on the last abdominal rings. There is frequently a light yellow coloured band stretching across the abdomen at the cornicular area. Beginning at the level of the cornicles eight conspicuous green spots on either side in the lateral grooves extend up to the head; on the thoracic segments the spots are larger and look like depressions.

Head brown, well rounded, about as long as broad with a median longitudinal line on the top, without any trace of frontal tubercles.

Eyes shining red, rather well developed, with ocular tubercles.

Antennae small, light green; distal part of fifth and whole of sixth joint black; hardly reaching up to the second abdominal spot; spur of the sixth much shorter than the base, an important feature of its anatomy.

Length proportions :—

	III.	IV	V	VI.
	12	7	7	6 + 3½
Lengths	0.20	0.11	0.11	0.10 + 0.051 mm.

The thoracic segments are well marked off; the prothorax bears the lateral tubercles. Just below the carina or lateral edges there is a row of dark dots, seen when the insect is examined under a strong binocular lens.

Cornicles very small, greenish, cylindrical, but with a clearly noticeable rim, much shorter than the cauda.

Cauda somewhat long conical, with one or two indentations on either side from which bristles originate; a little less than double the cornicles. Colour greenish, but the edge is black reaching up to the broad base.

Anal plate brown, in front of it is the somewhat crescentic, brown genital plate.

Legs green up to the coxae, only the tarsi and a small part of the knee black; the tibiae in old specimens show a fuscous line on the outer surface.

Ventral surface well segmented, with two lateral rows of green dots and very fine hairs across the rings; deeper green on the sternum.

Rostrum rather long, greenish, last two joints dusky, reaching up to the third coxae.

Face brownish, from where the rostrum arises outlined with black.

Measurements.—The average of early-season specimens is given below; late in the season, about the middle of November, they are smaller in size.

Body (up to)	..	..	..	1.50 × .75 mm.
Antennae	..	..	..	0.80 mm.
Cornicle	..	..	..	.066 ,,
Cauda	..	..	..	.12 ,,

Alate viviparous female.—Rather small in size; prevailing colour dark green, covered over by whitish bloom.

Head somewhat conical, about two-thirds as long as broad; black, without frontal tubercles.

Eyes dark red; in young specimens bright red.

Antennae black, but light coloured on the articulation, about half the length of the body and provided with a very small spur.

The basal one-third of the 3rd joint is narrower and lighter in colour than the rest of the joint which bears the sensoria.

Length proportions :—

	III.	IV.	V.	VI.
	14	10	10	7+4
Actual lengths ..	0.23	0.166	0.116	.11 + .06 mm.

Sensoria well defined, circular, varying in number from 4 to 6; usually five on the 3rd joint; the rest of the antennae crenulated.

Prothorax banded and laterally tuberculate.

Mesothorax normal, with shining black dorsal and ventral bosses.

Wings slender, hyaline; they look almost white and smooth; the veins are very faintly marked; second fork of the cubitus small, as shown in the figure.

Stigma greenish.

Posterior wings with two transverse veins.

Abdomen pyriform, with its anterior half darker green; a stripe in the middle and the edges similar in colour. The central part is lighter. The dots on the joint of the 7th abdominal segment and three on the edges are on carinae in front of the cornicles; the dots in the lateral grooves are always clearly defined.

Cornicles and cauda like those of the apterous viviparous female, light green in colour.

Lateral tubercles present on the first and seventh segments; small flattish ones may be seen even on the other segments.

Anal plate rounded posteriorly; genital crescentic, concave in front.

Rudimentary gonapophyses three, the central one the longest.

The rostrum reaches beyond the second coxae; its last joint is longer than the one before it, and carries a small bristle with a pit on either side just below the tip.

Measurements :—

Body	..	..	..	1.30 × 0.70 mm.
Antennae	..	..	..	0.60 mm.
Cornicle	..	..	..	0.06 ,,

Cauda	0.11 mm.
Wing expanse	8.00 „
Wing ..	3.70 × 0.75 mm.

The pupae have the anterior part of the abdomen much darker than the posterior. The head generally shows two brown bands placed lengthwise; the split for the final ecdysis takes place between them. The mesothorax and shoulders are greenish-white; the wing pads are tipped with a dusky colour. The rostrum reaches up to the third coxae.

Apterous oviparous female.—The apterous oviparous female is very similar to the apterous viviparous female in the salient features of its anatomy. The body is a little longer, somewhat fusiform, specially towards the cauda. The colour is greenish, with an olive or red-brown tinge. The cauda is broadly conical and blunt. A noteworthy feature is the presence of the swollen hind tibiae, which are slightly smaller than those of the apterous viviparous female in the ratio of 8 to 9. The surface is covered with small sensoria, placed mostly on the upper three-fourths of the length. They are readily recognised as they walk with an awkward gait.

Eggs.—The body contains only one egg, which occupies about three quarters of the whole abdomen. It is either laid in some convenient place or the body of the Aphid shrivels over it, serving as an additional protective covering. Probably in such cases it is too big to be passed and the mother dies in the attempt. The egg is of the usual elongate oval type, brown in colour; after three days or so it changes to shining black. These females are produced in late December and may even be secured in January or February.

Males.—This species is remarkable for the production of numerous different kinds of males. In November the apterous viviparous females begin to bring forth dull orange coloured young. These after their usual four moults become adults. The colour remains the same or gets slightly darker, the legs and antennae being proportionately longer and blacker than other forms. There is a very strongly developed genital armature consisting of a protrusible penis, contained within the lateral conical lobes, and the whole bounded within the elliptic black ring.

The antennal joints are distinct, quite black, and studded with numerous small secondary sensoria on all the joints; they are for that reason thicker also.

Length proportions :—

III.	IV	V	VI.
16	11	10	$7\frac{1}{2} + 3\frac{1}{2}$

Sensoria small and scattered all round; the numbers are on an average about 11–12 on III; 8–10 on IV; 12–13 on V and 1–3 on VI, besides the primary sensoria.

Cauda raised upwards, so that the genitalia comes into view even from the dorsum.

There are the following three different kinds of males, which normally form in the field as well as in the laboratory, and all the three kinds may be found on a plant at the same time :—

- (1) The commonest and the most abundant type is the "apterous male." It is rather long oval, much narrower than the apterous viviparous female. Black and orange pigment are well developed on the body. The rows of dots in the lateral grooves on the dorsum are very prominent. The other characters are as detailed above. The mesothorax is small and normal and the rostrum long and reaching beyond the third pair of coxae.
- (2) The second form is the "alate male." It is exactly like the apterous male in the possession of pigment, antennae and genitalia, but the mesothorax and metathorax resemble those of the alate viviparous female. It has wings which are in no way different either in size or form from those of the latter. The anterior wing of one is shown in the figure drawn to the same scale as the female wing. The body being slender they only appear large, otherwise there is no justification for calling them "voluminous" as seems to have been done in the case of other winged Aphid males.
- (3) The third kind seems only a modification of the second. Here, as shown in the figure, the individual possesses well developed thoracic bosses, containing muscles for flight, but there are no wings formed. At the last moult from the pupal stage wing pads emerge, but they are only small stumps instead of the normal wings. The other organs are similar. This may be designated as the "stumpy male."

Winged and wingless males in the same species are known to occur in other foreign species also, but I have come across no mention of this third type in the literature available in India. As specimens were collected in the field as well as in the laboratory it appears to be of regular occurrence.

Perhaps it may be possible to explain it on the hypothesis of scanty nutriment, as it has been customary to do in the case of parthenogenetic females, where alate and apterous forms can be produced almost at will. *Brachyunguis harmalae* seems to indicate that the constitution of the males also is similarly and even more susceptible to some sort of variation. In all probability, however, the main factor in the case of males is the necessity for "cross fertilisation" in the species. As noted above the *Peganum* Aphid is "protandrous," that is the males form much in advance of the females. The majority of them die in a vain search for the females, which might appear even a month later. But there are always a few males present when they mature.

The apterous males attempt to creep out of the colony in which they were born; the alate forms at once fly off and must effect cross-fertilisation, if they succeed at all. A failure in the attempt to form a winged male results in a "stumpy male," which functionally at least is as good as any other male.

In this connection may be mentioned another well-known fact about Aphids recorded by several workers in Europe and America, that a very large proportion of the eggs never succeed in hatching. This is not simply due to adverse conditions

like rain, frost, etc., because after these conditions have disappeared there still remain a large percentage which do not hatch. Some facts were observed while studying this species that seem to offer an explanation. For conclusive proof of course a special set of experiments with a definite aim would have to be carried out.

One or two insects to each branch were isolated on several branches of a *Peganum* plant in the laboratory in October 1913, and the twigs were enclosed in loose muslin bags, with the idea of watching their growth and collecting sexual forms. In the bags males were formed some days earlier than the females, the latter after the middle of November. Most of the males died soon after this, while the oviparous females remained wandering about, each carrying its large egg. By the end of December all the females had laid their eggs and only some viviparous females with young and pupae were left. None of the eggs hatched, probably because none were fertilised.

It is a somewhat parallel case with what is well known in Protozoa, like *Paramecium*. From the original "stem-mother" insect that hatches from the egg, we get in succession a large number of parthenogenetic generations, ending in the last one by the formation of true sexual individuals. The descendants of this common ancestor seem very much averse to mating among themselves. It would therefore appear that unless other males are introduced from a different stock an isolated colony however large its numbers would die a natural death, without being able to lay fertilised eggs to carry on the species into the next season. For this reason it very often happens that from single plants in the field as well as in the laboratory we seldom secure eggs that hatch, the clustering thousands being the descendants of only a single Aphid. Davis, Gillette and others have also noted that most of the eggs gathered in the insectaries shrivel up, while some of those laid and left unprotected outside do hatch. These in all likelihood must have been cross fecundated and fertile.

Peganum harmala, vernacular "Harmal" or "Aspand," is a bushy Xerophytic herb with white flowers and much-divided leaves. By some it is placed among the Rutaceae as an aberrant genus of that order, while others consider it to belong more properly to Zygophyllaceae. The plant grows abundantly in the neighbourhood of Lahore as well as in other similarly dry districts in India.

An active principle has been extracted from this plant, called "harmalin," which is supposed to be a specific against malaria. This substance permeates the whole plant and imparts to it a peculiarly offensive odour, which has earned for it the name of "devil's bush." It is probably this property which insures, in a great measure, an immunity to the plant from the attacks of animals. It is believed that even a camel would not eat it (*Lahore Gazetteer*, 1894).

The only serious pest that the plant has to contend against in nature, excepting one or two occasional visitors, is its own peculiar Aphid, which often completely smothers the growing shoots.

Systematic.—Among the Aphididae, up to very recent times, there were only two genera, *Hyalopterus* (Koch) with *H. pruni* as the type and *Brachycolus* (Buckton) the type of which is *B. stellariae*, distinguished by the cauda being longer than the cornicles. A number of other Aphids, with similar characters, have now been sorted by van der

Goot (1913) into three more new genera with differences of rather minor importance, such as the partial or total absence of lateral tubercles. These he has named *Semiaphis* for *A. carotae* (Koch), *Brachysiphum* for *A. thalictri* (Koch), and *Longicaudus* for *Hyalopetrus trirhodus* (Walker), etc.

The *Peganum* Aphid departs materially from the definitions furnished for these genera, particularly in the structure of the antennae. What is now regarded by modern writers as the sixth joint consists of two parts, the proximal known as the "base" and the distal, which is often filamentous, as the "spur," "unguis" or "processus terminalis." The latter when longer than the former was counted by the earlier authors as the seventh joint and two main divisions were recognised, one with six-jointed and the other with seven-jointed antennae. *Lachnus* and *Aphis* were representatives of these groups according to Passerini, Buckton, Lichtenstein and others. This has been shown to be an incorrect view, and the family Aphididae was split up into a larger number of more natural groups by Mordwilko (1908), who has been mainly followed by van der Goot (1913).

The "harmal" Aphid evidently belongs to their "Aphidina" tribe, but none of the genera comprised in it possess an antennal spur shorter than the base of the sixth article. I have thought it advisable, therefore, to place it in a new genus, *Brachyunguis*. Other distinctive features, besides, are the small cornicles, much longer cauda and the presence of lateral tubercles on the abdomen. Two more species belonging to this genus have been collected in Lahore.

Life-history.—The harmal plant usually perennates by means of an underground root-stock, when the portion above the soil dies out after the flowering period is over. This takes place twice a year. New shoots arise about February and, after flowering in March and April, die off in May or June. The same rhizome sprouts again after the rains, beginning from September and continuing up to about December, when again only dry branches are to be seen. So the periods of growth during the year are roughly in spring and autumn.

The *Peganum* Aphid has adapted itself remarkably to this periodicity in the growth of its host. The eggs laid in December hatch in February or March. The stem-mothers vigorously carry on parthenogenetic reproduction and one finds whole branches lined from top to bottom with rows of concolorous individuals. Alate and apterous forms are given birth to promiscuously until about the middle of April or early May, when some sexual individuals are formed. These are not very common, as only a few were observed in the colony. After the fruiting period is over there is very little sap left in the branches and the heat too becomes intolerable. The parasites of this Aphid also breed very quickly, the Coccinellids and Syrphids completing their life-histories in shorter intervals of time.

Almost all the Aphids are therefore destroyed, except those that have crept underground to take shelter in moist cool places. None are to be observed above the soil. Some eggs are at this time deposited on the plants by oviparous females. These eggs must hatch in September, when the hottest part of the year is over and the plants are reviving. It is also possible that some individuals creep out as apterous

females from places where they have been secreting themselves. Viviparous reproduction is again started with a fresh impetus and the tender shoots of the plants are crowded over by the small green pests.

In November rusty-red young are born which later turn into some kind of males, either apterous, alate or stumpy. The winged ones migrate to other colonies. In December the true females make their appearance and soon begin laying. If they get a chance of mating fertile eggs are laid, otherwise the sterile eggs are passed out which shrivel up later. Each female contains in her body a single big egg.

When active multiplication goes on, the young take only four or five days to become adult moulting four times, once a day.

The ants of the Myrmecine tribe build their nests in dry open places, and it is in similar places that the *Peganum* plant also grows abundantly. A close relation, therefore, seems to have sprung up between the Aphid and the ant. The craters of ant colonies often open below the infested bushes and their workers are incessantly coursing up and down the branches and gorging themselves with "honey-dew," which is freely exuded by the Aphids. It is not at all an uncommon sight to find the ants lifting up fallen plant-lice and depositing them again on the juicy twigs.

For observing them at close quarters some plants were brought into the laboratory in pots. After a few days it was noticed that, through the hole at the bottom of the pot, some workers of *Monomorium indica* (kindly identified by Mr. G. R. Dutt of Pusa) had entered the pots and established their galleries in the soil about the smaller roots. A large hole opened at the base of the plant, while a heap of small pellets was laid to one side as a result of this excavation. A week or so later a part of this colony that dwelt at a little distance from the pots, had shifted itself into the new galleries bringing all their larvae and pupae with them. The latter were often aerated in the sun below the branches. This ant is so diligent that in October and November it "milked" the plant-lice at all hours of the day and night. At no time during the night were the plants found to be entirely free from ants. Some of them were always present.

The ants often took the Aphids into their galleries also. This could easily be observed when any kind of plant-lice were brought into the laboratory. As soon as the ants discover that the plant-twigs are not yielding any sap to the punctures made by the Aphids and that therefore no honey was forthcoming, they bodily removed the Aphids into their nests, where very likely they served as food for their larvae.

It is also possible that the eggs of this species are stored by the ants in their nests, and taken care of till the fresh shoots arise in early autumn and spring. This fact was first observed by Lord Avebury in regard to an English ant (*Ants, Bees and Wasps*), and is recorded by Forbes and others from America, where *Aphis maidisradicis* is entirely dependent upon *Lasius niger* for its existence and distribution.

Such relations, I have reason to suspect, exist in Lahore also, though the question has not been thoroughly investigated yet.

Very few eggs were observed to be laid on portions of the plant above the soil, as is the case with so many other Aphids.

In June as noted above most of the plants die, but some of them even at this time put forth fresh shoots which remain green throughout the rainy season. On such twigs early in June some eggs were observed to have hatched into stem-mothers and the first generation were yellow; afterwards their progeny acquired the normal green.

***Brachyunguis letsoniae*, sp. nov.**

Host.—*Letsonia scandens*.

Distinguishing characters.—A fairly large, strongly pruinose, green species; cornicles small; cauda conical and larger than cornicles, both light green, the latter with a brown intercornicular band; antennae short; spur of 6th article smaller than its base; about seven sensoria on the 3rd segment; the insects cluster in the inflorescence of shiny-leaved *Letsonia*.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body rather large, long, oval and strongly arched; covered with white meal.

Colour green, lighter on cornicles, legs and antennae; a prominent row of mostly double spots on the lateral grooves, one pair on each body segment; between the cornicular bases stretching up to the carinae is a brownish-red band.

Head brown, with pits far apart for the antennae; front well rounded and convex.

Eyes blackish-red or light red in the young.

Antennae short, light greenish; distal joint smoky; they do not reach more than half way over the back. Article VI equal to V and much smaller than III.

Length proportions :—

	III.	IV	V.	VI.
	17	11	10	$6\frac{1}{2} + 4\frac{1}{2}$
Actual lengths	0.29	0.19	.17	.12 + .08 mm.

Thoracic segments well marked off, showing lateral depressions prominent on prothorax, which bears distinct lateral tubercles on the sides. Additional small lateral tubercles on the first and seventh abdominal segments.

Cornicles greenish in colour, small, cylindrical, very slightly incrassate at base, a little more than twice as long as broad, smaller than cauda.

Cauda greenish, conical, very broad at base; the distal part beset with pointed teeth, basal part smooth; about one-third as long again as the cornicle.

Anal and genital plates somewhat rounded and distinct.

Rudimentary gonapophyses three in number.

Legs rather stout, with black tarsi.

Rostrum greenish ; tip blunt ; last segment dark, of equal length to the one in front.

Measurements :—

Body	1.85 × .80 mm.
Antennae	1.05 mm.
Cornicle	0.11 ,,
Cauda	0.18 ,,

Alate viviparous female.—Body slightly smaller than in the apterous female.

Colour similar, with dusky preponderance over antennae, legs and thorax.

The pattern on the abdomen, as shown in the figure, consists of rows of blackish spots, two on the lateral grooves and two on either side of the mid-dorsal line ; three large round spots on carinae in front of the cornicles ; the post-cornicular segments show three bands across them, the first one the largest.

Head dark, somewhat pointed ; antennae directly implanted in the frontal pits, situated somewhat laterally, ringed with black, otherwise greenish-yellow, about half the body length ; half of 3rd article narrow basally, swollen and black distally.

Length proportions :—

	III.	IV	V	VI.
	18	12	11	8+5 (average).
Lengths	.30	.20	.19	.13+ .08 mm.

From 6 to 8 fairly large secondary sensoriae grouped only on the distal black half of the 3rd article ; 1 or 2 of these are smaller in size than the other 6.

The primary sensoria on V and VI possess a hair-rim. From the fourth joint onward the antennae are scaly.

Eyes red.

Prothorax brownish-green, with lateral tubercles and a black transverse band.

Mesothorax with usual black shining muscle bosses.

The metathorax has two black dots placed laterally, almost in line with the lateral grooves of the abdomen.

Lateral tubercles on the 7th abdominal segment pointed and conical ; there are flat ones on the other segments.

Cornicles green, similar to the apterous female, tips vasiform.

Cauda greenish, larger than cornicles ; conical, with a broad base.

Genital plate crescentic, concave anteriorly ; anal plate large and rectangular.

Legs with tarsi and distal femora blackish, otherwise brownish-green.

The rostrum reaches to the second coxae ; between the third coxa there is a conspicuous black depression.

The wings have the normal "Aphidine" venation ; veins thin and brownish ; stigma throughout greenish in colour. Stigmal vein, as shown in the camera drawing, uniformly curved, while the second fork of the cubitus is much nearer the apex of the wing than the cubitus itself.

Measurements (on an average) :—

Body	1.65 × 0.73 mm.
Antennae	1.1 mm.
Wing expanse	6.1 „
Wing	2.80 × 1.2 mm.
Cornicle	0.12 × 0.05 mm.
Cauda	.16 mm.

This insect has been collected only from *Letsonia scandens* in the Botanical Garden during the month of October, 1913. Soon after this it disappeared and was never found afterwards even during March and April. *Letsonia* is neither a common nor perhaps an indigenous plant in Lahore. For the sake of its beautiful silvery leaves it is cultivated in gardens as an ornamental creeper.

The Aphid infests the tender young branches and the inflorescences of the plants.

Nothing is known about its further history and probably some alternate host may be found later.

The species is named after the host plant and evidently belongs to the new genus *Brachyunguis*.

***Brachyunguis* (?) *carthami*, sp. nov.**

Host.—"Wild safflower" *Carthamus oxycarpi*.

Distinguishing characters.—Body oblong; ashy-gray on account of the thick mealy coat; two large rectangular blotches internal to the cornicles and rows of other black spots on either side with one in the middle; cornicles black, smaller than cauda; lateral tubercles large and antennae short with sensoria even on the joints of the apterous viviparous female; it appears in the hot months of May and June.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body oblong to ovate, rather depressed, thickest in the cornicular region; showing distinct carinae in most specimens.

Colour ashy-gray or whitish, in life almost cryptic on its host; but this is due to a very thick layer of pulverescence which conceals the real reddish-brown colour of the insect.

The pattern on the body becomes visible on removal of the meal with a drop of alcohol. It consists of two prominent irregularly-rectangular spots, internal to and slightly in front of the cornicles. A median row of dots extends from behind the head right up to the cauda; on the thoracic segments the spots are largest and faintest on the anterior abdominal segments; a double row is noticeable near the lateral grooves and still another is formed by the black and conspicuous lateral tubercles. The skin bears a mosaic of anastomosing lines.

Head rounded in front, black, about as long as broad.

Eyes black.

Antennae black, arising from depressions; they are very short, hardly reaching beyond the anterior third of the body; the joints are well marked and intricate.

The spur is only slightly smaller than the base.

Length proportions :—

	III.	IV	V	VI.
	12	6	6	$6\frac{1}{2} + 5\frac{1}{2}$
Actual lengths	0.20	0.10	0.10	.11 + .09 mm.

Sensoria are present on articles III and IV, from 3 to 5 and 1 to 2 respectively.

The prothorax has a large lateral tubercle and three spots on the dorsum.

The mesothorax and metathorax have their median and lateral spots particularly large; they almost form one continuous blotch in some individuals.

The abdominal segments possess lateral tubercles the largest of which are situated on the first and seventh segments. The others are small but black and in macerated mounts come out exactly like sensoria. Each black tubercle appears to be associated with a small sensorium.

The posterior segment frequently overlaps the cauda.

Cornicles black, imbricate, somewhat truncate conical, not quite cylindrical as in the type of this genus. The base is about two-thirds the length and the apex less than half. It is about one-tenth of a millimetre long.

Cauda broad-based, somewhat conical; apical portion black, basal hyaline except the edges. It is about as long as its breadth at base; a little longer than the cornicles in the ratio of 3 to 2.

Anal plate conspicuous black, rounded posteriorly.

Genital plate somewhat overlapping; a little larger and concave anteriorly.

Rudimentary gonapophyses three in number; the central one the largest and beset with a few spines.

Legs rather short and stout, dark brown; tarsi and precoxal areas black.

The rostrum reaches up to the middle of the 2nd and 3rd coxae.

Measurements (in large individuals) :—

Body	2.0 × 0.95 mm.
Antennae	0.70 mm.
Cornicles	0.10 ,,
Cauda	0.15 ,,

Alate viviparous female.—Body ovate, mealy.

Colour similar to the apterous viviparous female.

Antennae, head, prothoracic band, mesothorax, legs, cauda and cornicles all black.

The pattern on abdomen is also similar to the apterous viviparous female, except that on carinae in front of the cornicles there are three large circular spots and a small one near the base of the cornicles. The rectangular blotch is absent, but on the margins there is just another row of tiny dots in addition to the median and lateral ones.

Head broad, with prominent eyes and ocelli.

Antennae very much like that of the apterous viviparous female; the spur is small.

Proportions (on an average) :—

	III.	IV	V.	VI.
	14	6	6	$6\frac{1}{2} + 5\frac{1}{2}$
Lengths	0.23	0.10	0.10	$0.11 + 0.09$ mm.

The whole length about three-fourths of a millimetre.

Sensoriae from 5 to 7 on article III and from 2 to 3 on article IV.

The primary sensoriae are provided with hair-rims and are normal.

Both pairs of wings are of the same type as in Aphidinae; the veins are well marked and the stigma brown.

The lateral tubercles on the abdominal segments are much larger and their sensorium-like character is brought out with great distinctness as shown in the figure.

Cornicles more cylindrical than those of the apterous female, but of the same form and size; black, imbricated and subconical.

Cauda more pointedly conical; the distal half bearing the usual curved hairs is black and toothed. The ratio of the cornicle and cauda is as 5 to 8.

Rudimentary gonapophyses three.

Legs long; sole-pustules present above tarsi.

The rostrum reaches up to the 2nd coxae; last joint twice as long as the one before it.

Measurements :—

Body	1.90 × 0.94 mm.
Antennae	0.75 mm.
Wing expanse	5.10 ,,
Cornicle	0.09 ,,
Cauda	0.12 ,,

The insect has been collected only during May and June on *Carthamus oxycarpa*, a wild spiny compositous weed which grows very abundantly in waste land. The particular spot where it turns up every year is a fallow piece of land in the fields between the Chhota Ravi and the first "Rakh" (reserved forest) along the road leading to the railway bridge.

There are a number of ant colonies in the vicinity and the Aphid is very rarely found unattended by them. Frequently a nest opens just about the roots of the host-plant and the ants coursing up and down the stems are a sure sign of the presence of the Aphid.

It is a striking fact that this Aphid does not thrive well when kept on plants in the field isolated from the ants. There are so many Aphid enemies to contend against during these months that only those colonies have a chance to live and grow that are protected by the ants. It was also noticed that plants on the craters of ant's nests were thickly populated with Aphids, while those even a foot or two away were entirely free from them. Probably their distribution is controlled by the ants to a certain extent.

Life-history.—During the rest of the year the life-history is still unknown. There is only one host; cultivated saffron (*Carthamus unctorius*) is not known to be attacked and is not grown in Lahore.

The systematic position of this new Aphid is quite interesting. I have very hesitatingly placed it along with the *Peganum*-species in the genus *Brachyunguis*. The spur being shorter than the base, the cornicles smaller than the cauda, and the presence of lateral tubercles are features in common with that genus. But important differences, some of them given below, mark it off clearly from *Brachyunguis*:—

- (1) The cornicles are black, conical and broad-based, not hyaline or cylindrical.
- (2) The spur of the 6th antennal article is not so small, sometimes it is almost subequal with the base.
- (3) The cauda is not quite double the length of the cornicles but much less.
- (4) Specially noteworthy is the presence of secondary sensoria on articles III and IV even in the case of the apterous viviparous female.

Of all the genera catalogued from Europe and America that combine *Aphis*-like characters (*Aphis*, Linn., Mordw., van der Goot) with the cornicles smaller in length than the cauda, this species approaches nearest to *Brachyunguis*, gen. nov. It, however, considerably diverges from the type. But for fear of multiplying and erecting new genera for single species I have tentatively allowed it to stand in this group.¹

Eichochaitophorus himalayensis, sp. nov.

Host.—Several species of *Salix* that grow along the banks of canals, streams and rivers.

A small insect, chiefly sitting along the midrib of the leaves, or encrusting the tender shoots just above the stipules. Light greenish to yellowish in colour; two crescentic bands around the bases of the cornicles on the dorsum, meeting two elongated spots on the first abdominal segment; another blotch on the thorax; all of a dark green colour.

Cornicles truncate, with a network of lines on the surface; cauda constricted, knob-like; anal plate notched and a few large sensoria on the third joint of the winged female are distinctive characters. Plenty of sooty fungus blackens the lower leaves of the host-plant and ants both small and large are always in attendance.

DESCRIPTION.

Apterous viviparous female.—Body oval to ovate, covered with long bristly hairs, directed backwards.

¹ [*Brachyunguis carthami*, Das, is indeed somewhat different from the other species of the genus, especially in the somewhat conical form of the cornicles, in which respect it shows some relation to the genus *Longiunguis*, v. d. G. The different other characters of this species however, such as the shortness of the "unguis" (spur) and the very flattish, almost rudimentary lateral tubercles, make it advisable that *Br. carthami* should not be separated from its original genus.

Secondary sensoriae on the antennal joints of the apterous female, as present in this species, are likewise found, as far as known, in *Aphis jacobaeae*, Schrk. and *Aphis senecionis*, Williams. P. v. d. G.]

Head yellowish ; front broad, carrying two groups of bristles.

Eyes brilliant red.

Antennae short, reaching about half way down the back ; basal part concolorous with head, the distal part from fifth joint onwards black ; sparingly hairy ; last joint slightly curved.

Length proportions :—

	III.	IV	V	VI.
	16	8	6	5+11
Actual lengths	0.26	0.14	0.12	0.08+0.20 mm.

No sensoria are present except the normal primary ones.

Prothorax as broad as head ; on the lateral sides of the groove behind is a small tubercle.

Mesothorax large, with an irregular green black blotch, broad in front and narrow behind and meeting with a smaller spot on the metathorax. Near the lateral edges there is another small faint dot.

Abdomen very bristly ; on the first abdominal segment there are two flattened latero-dorsal green spots and another in their middle with which they are often confluent. Another pair of broad crescentic bands passes internal to and around the bases of the cornicles, leaving large circular areas around them and extending up to the last segment but one. The seventh annulus also bears two greenish spots. The pattern is shown in the figure.

The cornicles in surface-view appear ring-like, very little above the body level, brown. A clear circular space of a light greenish colour brings them into relief. Under a high power, in lateral view, they are truncate, with a wide base and narrower somewhat flanged tip. There are circular lines over the basal part and a network of them on the distal part (see figure).

The cauda projects beyond the body as a spherical knob, between which and the broad base there is a narrow constriction. Knob yellow-coloured ; there are a few curved hairs over it ; length about double the cornicles.

The anal plate can be seen from above ; it is almost rectangular, with a shallow but a very distinct notch or depression in the middle of the posterior border. Its bilobed character is just indicated and is not at all so well marked as in *Callipterina*.

The genital plate is not well seen ; the colour, like the anal plate, is greenish-yellow, but the vulva between is quite large.

Rudimentary gonapophyses four ?.¹

Legs normal, hairy ; of the same colour as the body throughout except the dusky tarsi ; the "sole-pustules" are indistinct above them.

Rostrum very light greenish, almost hyaline, showing a clear narrow brown groove in its middle running up to the slightly darker extreme tip. It reaches up to the third coxae.

¹ [The number of rudimentary gonapophyses was not filled in in the original manuscript ; very likely the number is 4, as in other Chaithophorinae. P. v. d. G.]

Measurements (the size is very variable) :—

Body length	1.35—1.50 mm.
Breadth	0.70—0.85 „
Antennae	0.75 to 0.90 „
Cornicle	0.06 mm.
Cauda	0.10 „

Pupa long oval; on the brown head the red eyes and smaller ocelli are visible. Prothorax and central mesothorax green. Wing-pads whitish. The abdomen shows a similar pattern on the back as in the apterous viviparous female.

Alate viviparous female.—Body a little smaller than the apterous viviparous female, but very variable, with long hairs all over the body situated on tubercles.

Head dark brown, slightly grooved in front; median ocellus placed ventrally.

Eyes red.

Antennae dark, short, reaching half way down the back, somewhat curved near the apex.

The length proportions of the articles vary considerably, but usually III is subequal to IV and V taken together and smaller than VI including the spur, which is less than three times the base (about two and a half times). The spur in most specimens is a little shorter than III but sometimes subequal.

Average proportions :—

	III.	IV.	V	VI.
	16	9	7	5+13
Actual lengths (variable)	.26	.16	.14	.09 + .21 (=.30 mm).

The secondary sensoria are large and few in number, placed only on the distal half of article III. The number varies from two to five (2-5), usually there are four. There are no hair-rims and the double contour is circular.

The primary sensoria possess a circlet of hair and are of normal type.

Prothorax and mesothorax normal, black; after immersion in alcohol two spots are seen on the former.

Wings hyaline; venation normal but variable, as shown in the figures. Costa thicker than other veins, but not as thick as the subcosta. Stigma brown; its posterior border bears a row of characteristic hooked spines, and behind these runs another streak like a false vein. The cubitus sometimes has three forks. The posterior wing rarely has two oblique veins, usually only one.

Abdomen pyriform, greenish-yellow, with a similar pattern of dark green bands as in the apterous viviparous female, that is two large latero-dorsal spots on first abdominal, two crescentic ones around cornicles not meeting with each other anywhere, and two small spots on the precaudal segment. There are no lateral tubercles but two rows of black dots are well seen on the lateral grooves and margins.

The cornicles appear as rings from above, with a clear light greenish space around their bases. They are similar in form to those of the apterous viviparous female but

not so broad at the base, and the network of anastomosing lines extends much nearer the base; there are fewer circular lines. The length is a little greater than the width at the base; smaller than the cauda.

The cauda and anal plate are of the same form as in the apterous viviparous female.

Rudimentary gonapophyses four ?.¹

Legs longer and dusky.

Rostrum up to a little beyond the 2nd coxae.

Measurements :—

Length	1.05—1.45 mm.
Breadth	0.45—0.65 „
Antennae	0.80—0.96 „
Wing expanse	3.70—4.30 „
Wing	1.90 × 0.70 „
Cornicle	0.080—0.095 mm.
Cauda	0.10 mm.

Systematic.—This small pretty Aphid of *Salix* evidently belongs to the genus *Eichochaitophorus*, recently founded by Essig to receive a populous Californian species (*Pom. College Jour. Entom.*, May 1912).

So far there is only one species in the genus and I add another from India. The Californian insect is very variable in all its structural characters and so is the Indian one. It would be quite possible in some cases on a cursory examination to confuse specimens of the two species mounted in Canada balsam with one another. But the main points of difference are the smaller size and different host of the Indian insect. The green pattern on the back is also different as well as the length proportions of the antennal articles. The number of sensoria in the American insect ranges from 3 to 9 while in the Indian insect there are from 2 to 5 only. The posterior wing in most cases has only one oblique vein, though occasionally a second one is present either wholly or in part.

The generic characters in the form of the cornicles, cauda, anal plate and the presence of a row of short hooked spines or hairs on the posterior border of the stigma are all alike.

The species is distributed over the plains of Northern India and may be collected from March to September, on the banks of streams and canals that branch from the main rivers. The indigenous home appears to be the Himalayas from where rivers issue and spread the species in the plains along with the host-plant. Near hills it is more abundant and has been observed at Saharanpur, Jammu, Rikhikesh, etc. I have for this reason called it *Eichochaitophorus himalayensis*, sp. nov.

Life-history, etc.—After the rains, in September, the leaves of *Salix* spp. begin to be attacked very severely by a rust, *Puccinia Kuui* (identification by Dr. Butler, Pusa). The Aphid, also, not getting sufficient nourishment leaves this host and prob-

See footnote, p. 241.

ably migrates to some other place. The further life-history and the formation of sexuals has not been noticed.

There are the usual insect enemies; specially active are *Scymnus communis* and *Chilomeles sexmaculata*.

The small brown ants (Myrmecinae) and larger ants (Camponotidae) are always found attending the Aphid colonies.

Callipterus trifolii (Monell).

(Lucerne or Clover Aphis).

Synonym.—*Chaitophorus maculatus*, Buck.

Literature :—

- (1) Monell, *Canadian Entom.*, XVI, p. 14, 1882 (contains the original description).
- (2) *Ind. Mus. Notes*, IV, p. 277, and a reprint of the same in *Indian Insect Life* by Lefroy, p. 746 (gives an indifferent description with figures under a wrong name).
- (3) Davis, *Ann. Entom. Soc. America*, I, 1908 (gives a description with figures).

This Aphid is very widely distributed in India and has been collected at most of the places where lucerne (*Medicago sativa*) is grown as horse fodder.

The first notice of it is to be found in *Indian Mus. Notes*, Vol. IV, no. 5, 1899, when it was reported from the Jodhpur State Farm.

The specimens were submitted to Buckton who gave a short description of it as a new species of *Chaitophorus*. It seems to have nothing in common with the characters of that genus but, as reported to me by Mr. J. J. Davis and compared with published descriptions, is evidently identical with the American insect *Callipterus trifolii*, the yellow Aphid of clover.

I have found it in several districts in the Punjab on various species of *Medicago*, also on the introduced Egyptian clover, from March to May. The lucerne Aphid is medium-sized, somewhat fusiform, pale yellow in colour, with rows of dusky spots on the back. These spots make it appear under a low lens or to the naked eye of a dark grayish colour or mouse colour.

It is extremely sensitive and the adults are very often found singly or with a brood of a few young around them. With the slightest touch or shake of the twig, on the under sides of the leaves of which they may be sitting, they fall to the ground. After remaining perfectly still for a short time—feigning death—they scramble up the branches again. On account of this habit it has been found much easier to collect them by spreading a piece of cloth under the plant and then shaking it gently. The young are not so active, nor are those that are about to moult or that are reproducing.

Both apterous and alate females reproduce parthenogenetically, which is said to be rather unusual in this genus.

As accurate and fairly detailed descriptions are available in American literature, no further morphological account is given here.

Systematic.—The generic position of this species seems to be an unsettled question so far. That it is not a *Chaitophorus*, as Buckton took it to be, is perfectly clear. It

evidently belongs to the tribe Callipterina, Mordw. A key to the genera has been published by Wilson in the *Canadian Entomologist* for August 1910, based chiefly on the relative lengths of the spur and the base of the sixth antennal segment, taken in conjunction with the form of the cornicles. According to these characters it may as well belong to *Myzocallis* as to *Callipterus*, but its cornicles differ from both. The antennal lengths are not now regarded as very satisfactory characters for the separation of genera, so if we overlook that character, the species would fit into *Tuberculatus* of Mordwilko with characters as emended by van der Goot (1913). The new type taken by the latter is *Callipt. betulicolus* (Kalt.), again an aberrant species, but possessing several features in common with the lucerne Aphid under review. These features are:—

- (1) Capitulate hairs over the body.
- (2) Lateral tubercles on the abdomen.
- (3) The presence of apterous parthenogenetic females with sensoria on their antennae.

In view of this van der Goot has recently proposed that a new genus may be erected for *C. betulicolus* (Kalt.) and that *C. trifolii* (Monell) may be styled *Neocallipterus*.

For the present therefore we may leave it as an open question until further knowledge of these forms is forthcoming. Some further information may be expected in a Bulletin on the "Yellow Clover-Aphis" that is about to be issued by U.S. Department of Agriculture.¹

Shivaphis, gen. nov.

Type: *Shivaphis celti*, sp. nov.

Characters.—Head grooved in front, without frontal tubercles.

Antennae long, ringed with black; 3rd joint longest, equal to any of the two following which are subequal; article VI furnished with a nail-like process as in Lachninae or in *Phyllaphis*.

Sensoriae somewhat elliptical.

Wings with cubitus twice forked, with clouded veins which flatten into pigmented areas at the apices; stigma similar.

Abdomen ovate and provided with four rows of wax-glands, which are also present on the head and thorax and secrete profuse quantities of white powdery and fibrous flocculence.

Cornicles ring-like, small, almost flush with the level of the body, not rising above that of the glands.

Cauda well developed, cylindrical, resting upon a broad watchglass-like base.

Anal plate in viviparous females deeply bilobed as in Callipterinae.

¹ [Since Mr. Das finished his manuscript, a detailed account of the "Yellow Clover Aphis" has been published by Mr. J. J. Davis (*U.S. Dept. of Agr.*, techn. series, nr. 25, part 2, 1914), in which paper the species is still called *Callipterus trifolii*, Monell. Later investigations by Theobald have definitively settled that the "clover-aphis" is identical with *Aphis ononidis*, Kalt., and therefore has to be called in future *Callipterus ononidis*, Kalt. (see Theobald, *African Aphididae II*; *Bull. Ent. Res.*, Vol. 6, 1915, p. 134) P. v. d. G.].

Rudimentary gonapophyses three in viviparous females and four in oviparous females.

Rostrum very short.¹

Shivaphis celti, sp. nov.

Host.—*Celtis australis* (The Indian Elm).

Vern. "Batkar"; the fruit is known as "Indarba."

Distinguishing features.—This pretty insect is not likely to be mistaken for any other occurring anywhere in the vicinity, so characteristic is its appearance even to the naked eye. They give one the idea of small pieces of cotton wool, ranged along the ventral veins of the *Celtis* leaves. They jump off with the slightest touch or shake of the branch and settle upon another leaf or twig always scrambling to the lower surface, unless the upper surface happens to be quite in the shade.

Under a lens the species shows the whole body, including the legs and wings, quite laden with the waxy flocculence, which flows at the two ends of the body into long thick, hair-like processes. Over the white back four rows of dark glands running lengthwise from the head to the cauda are conspicuous.

Other distinguishing characters are:—

The speckled wings; very small ring-like cornicles; U-shaped, bilobed anal plate, and the ringed antennae, bearing a very small nail-like terminal process to the 6th article.

Figures 1 and 2 show it as it appears to the naked eye and under a lens respectively.

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body covered on all sides with white woolly flocculence, streaming out more particularly from the head, legs, anal end, and the lateral and dorsal glands; after removal of the flocculence with a drop of spirit the insect shows an elongated oval form, with wavy or festooned edges. Large glands occupy the lateral convexities.

Prevailing colour pale or dusky greenish; intermixed in the colony pink-coloured individuals are more abundant from September to November than in March and April.

Head black or dark green, without frontal tubercles; the front is grooved, with a large gland on either side. Two more glands on the dorsal surface. These secrete the flocculence which often projects anteriorly or upwards.

¹ [A few corrections and additions are necessary to the characters of the genus *Shivaphis*, as given by Mr. Das:—

- (a) Mr. Das does not mention the presence of a distinct hair-rim with the primary sensoriae and a very small one on the secondary sensoriae.
- (b) The cornicles are distinctly raised above the level of the dorsum, their length being about half their diameter.
- (c) The rudimentary gonapophysae in the viviparous females are 2 in number; in most cases they are fused together. In the oviparous female the number will very likely be the same.
- (d) No mention is made of 2 well-developed enlarged "empodial hairs" ("haftläppchen") at the base of the tarsal claws, as present in all Callipterinae. P. v. d. G.]

Eyes brilliant red, with well-developed ocular tubercles.

Antennae wide apart at their bases, reaching half way down the back; junctions of articles black, alternating with the rest of the segment that is whitish or yellowish; appearance ringed. Last segment (VI) with a very short spur or "processus terminalis," similar to that found in Lachninae or *Phyllaphis*; 3rd article longest, about twice the size of IV, V or VI, which are all subequal¹:—

	III.	IV	V.	VI.
Lengths	0.34	0.17	0.17	0.16 mm.

Prothorax well defined, elliptic, broader than long; lateral edges rounded, bearing large black glands; four more glands in two pairs, one behind the other, on the upper surface, and two latero-dorsal black depressions.

Meso- and metathorax like the abdominal segments furnished with two median and two lateral dusky round glands.

The abdomen bears four rows of black spots which are the wax-secreting glands, one on either side on the carinae and bulging outwards and two on the middorsum. Over the greenish or pinkish dorsal surface three or four faint whitish longitudinal lines or grooves are noticeable; transverse segmentation of the abdomen cut these grooves across, marking the surface into squarish areas in the middle of which lies a gland. A row of blackish depressions runs upon the lateral grooves, continuous along the whole body. The two median spots of the penultimate segment are larger, while those of the last one are confluent with each other. This segment has no lateral glands.

Cornicles little more than black rings with whitish centres, hardly rising above the level of the wax-glands; outline double, like a sensorium.

Cauda of the colour of the body, with the tip only dusky; almost cylindrical, resting on a broad watchglass-like swollen base; there are strong spines as usual.

Anal plate blackish, deeply bilobed or cleft like the letter U; the two limbs of the U enclose the cauda and project as far, so that three processes seem to be present at the anal end.

Genital plate much in front, large and prominent, about the same colour as the anal plate. With a high power three rudimentary gonapophyses can be discerned just behind the genital plate.²

Legs pale brown, almost of the body colour, except the stout black coxae, specially the hindmost ones. Distal femora and tarsi also black. In life covered with thick flocculence.³

¹ [The spur of the sixth joint is not so very short, its length being about $\frac{1}{4}$ the basal part of the ultimate joint.

On the under side of the antennal joints 3, 4 and 5, there are present at the tip a number of small wax-glands, of the same form as those on the dorsum. P. v. d. G.]

² [The number of rudimentary gonapophysae is apparently 2; they are placed very close together and often seem to be united. P. v. d. G.]

³ [On the basal part of the tibia and the distal half of the femur small wax-glands are visible of exactly the same form as those on the dorsum of the body. P. v. d. G.]

Rostrum very short, just reaching a pit between and in front of the second pair of coxae. The short beak is probably correlated with the sensitive nature of the insect; some other Aphids that also have a similar beak resemble it in the habit of dropping down at the slightest alarm.

Measurements :—

Body	1.90 × .85 mm.
Antennae	1.20 mm.
Cauda	0.12 „
Cornicle	0.05 „ in diameter.

Alate viviparous female.—The alate female has often a larger amount of white flocculence, specially on the head, from which some pieces flow towards the front and others backwards and upwards; from the sides two very long and thick masses project backwards along the margin of the wings and extend beyond them like a tail. There is a predominance of a dark colour over the greenish yellow (or pink in September, October and November). The size of the individuals varies a great deal, particularly those kept in rearing pots under glass chimneys which are distinctly smaller in size.

Head black; front with two black wax-glands with a groove between as shown in the figure. Two more glands situated behind between the dark red eyes.

Antennae long, about the size of the body, ringed with black at the joints of the two articles; the third is the longest, black in the middle, and the 6th has a very short spur.

Length proportions :—

	III.	IV	V	VI.
	33	16	15	12+3
Actual lengths	.55	.25	.24	.24 mm.

Sensoria about the middle of the 3rd article, the black portion with from 9 to 11 sensoria. They appear to go in pairs; the number in larger specimens may even run up to thirteen. The third joint in such cases is longer. All the sensoria are circular and placed in one line.¹

Prothorax similar to that of the apterous female; two pairs of glands form a single transversely elongated band; the band is darker than the prothorax and raised above its level. Two glands present on the rounded lateral side, but there are no lateral tubercles.

Mesothorax with shining black muscle-bosses; on the dorsum and sides a conspicuous black stigmal spot. The lateral lobes of the muscle-bosses are again subdivided by a longitudinal line. Those towards the inside are light in colour and smaller in size.

Wings iridescent, long and slender, stigma smoky; all the veins are clouded with

¹ [The primary sensoriae have a distinct hair-rim; the secondary sensoriae show an exceedingly short one. P. v. d. G.].

dusky pigment. At their ends near the margins the flattening of the nervures is conspicuous; the cubitus after its first fork bends sharply and the two branches of the second fork are equal. Stigmal vein hardly visible near its basal end, but a clouding at the distal end is always present, the wing appearing speckled. The hindwings also have similar clouding at the apex of the wing and vein ends.

The pattern on the abdomen is slightly different, but in the main is the same as in the apterous female; on the first three abdominal segments the blackish glands of the middle pair are large and confluent with their fellows, and form a straight or slightly crescentic band quite raised above the level of the abdomen, as shown in the plate. The glands on the carina make the contour of the abdomen wavy. On the hind segments the glands again become larger than those of the middle segments which have them only faintly marked, while on the penultimate segment all are confluent in a single mass.

The cornicles are like rings; rather large, with a distinctly double outline.

The cauda and anal plate are exactly like those of the apterous female.

The legs are more dusky and possess larger flocculence.

The rostrum is small, just reaching to the black sternal bosses. On the ventral surface just above the coxae a black blotch is noticeable a little on the lateral side; the segmentation of the abdomen is much more marked on this side.

Measurements :—

Body	1.45 × .75 mm. (may be smaller or larger).
Antennae	1.50 mm.
Wing expanse	6.5 „
Wing	2.75 × 0.98 mm.
Cornicle	about 0.05 mm. in diameter.
Cauda	0.12 „

Glands.—Each gland consists of a large number of more or less regular polygonal plates, grouped together into a rounded elevation. Over the surface of each plate are present from 5 to 8 small black dots or pores from which the flocculent secretion exudes in the form of very fine threads. They either retain their long form for a considerable time and give rise, by their coming together, to the larger threads or hairs already noticed, or break down and form the cottony mass.

The plates near the anal end and on the head are a little larger; the number of pores on the surface also is greater and the majority of them are disposed in a circle round a single central pore.

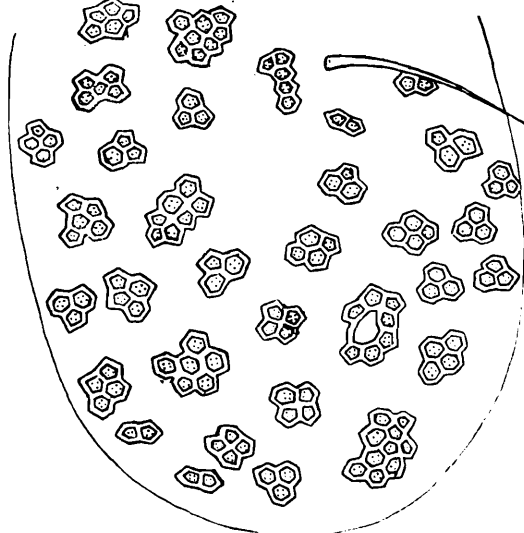


FIG. 3.—*Shivaphis celti*, sp. nov.
Part of wax-plate with facets of alate female, × 890.

The cottony flocculence resembles very much a similar secretion met with in Pemphiginae and Chermesinae, but the structure of these glands is quite different.¹

Alate male.—Body rather slender; its small size and black colour differentiate it from the alate viviparous female. There are alate viviparous females which are of the same dimensions and even smaller, but their bodies are either greenish or pinkish, never dark rusty which is the prevailing tinge in the male. Moreover, the antennae and legs are black throughout, the former unlike the ringed antennae found in viviparous females.

Head black, with conspicuous eyes; much broader than long; front bifid; not very flocculent in life.

Antennae comparatively long; 3rd joint longest; all the rest subequal.

Length proportions :—

	III.	IV	V	VI.
	33	16	15	15
Lengths	0.55	0.26	0.25	0.25 mm.

Sensoriae somewhat elliptical, not quite circular; present on all the joints. On article III about twenty (20); on IV, 8—10; on V, 8—10; on VI, 6—8. These are in addition to the primary sensoria on articles V and VI. Almost all the sensoria have a hair-rim; on the primary ones it is more distinct, consisting of larger hairs.

Prothorax with rounded lateral edges, narrower than the head, concolorous; two glands of a whitish colour are conspicuous near the posterior edge.

Mesothorax and metathorax, including wings and legs, like the alate viviparous female, but darker.

Wings not voluminous as mentioned by Western authorities for males in other Aphids. In the males of other Punjab Aphids also I did not find the wings voluminous.

Abdomen narrow, well segmented, blackish rusty, with the usual four rows of glands.

Cauda distinctly smoky; below it is the conspicuous genital armature. It consists of two lateral claspers, triangular in form and with the apices directed forwards; their ventral surface has a black boundary and is beset with whitish spiny tubercles. Between them, in the angle formed by their inner edges and nearer their bases, is the conical light-coloured, small penis, also bearing tubercles ending in curved spines. On either side of the penis running backwards and outwards is a lateral black ridge. There is a ridge in front of the two claspers and two more, one on either side,

¹ [Mr. Das' description of the wax-glands of *Shivaphis celti* not being quite accurate I feel obliged to add the following notes :—

The wax-glands open on rounded or ovate, somewhat chitinized wax-plates. A plate bears numerous groups of facets, the groups being always distinctly separated from one another; each group consists of a small number of facets (mostly 4 to 10), of a polygonal form, with a broad chitinous rim, and completely fused together. The membrane of all facets shows some fine pores, through which the waxy substance is secreted.

Each plate bears a single long plate-hair; the outlines of the plate are in most cases not distinct. P.v. d. G.].

enclosing the genital armature-like hoops. The whole structure is shown from the ventral side in the camera lucida drawing.

The anal plate is not strongly bilobed in a U-shaped manner as in the viviparous female, but the bifid character is indicated by a small notch, as illustrated.

Other characters are like the alate viviparous female.

Measurements :—

Body	1.25 × 0.48 mm.
Antennae	1.45 mm.
Wing expanse	5.10 „

The males are fairly abundant in early December; late in the month they become scarce and are only to be found as isolated specimens here and there.

Oviparous female.—Long rows of oviparous females are to be noticed in late December on the under sides of yellowish leaves along the larger veins. The black legs, scarlet bodies and tapering abdomen make them conspicuous; the woolly flocculence also is not very abundant. Four rows of blackish glands run along the dorsum with slight grooves in between; the segmented abdomen causes similar grooves or shallow lines in a transverse direction. The body, therefore, appears as if divided into squarish areas each enclosing a gland in the middle. The sides of the thoracic segments often become very dark, almost as black as the head or legs.

The pore-like cornicles appear as if they were very large sensoria with a double outline; they are slightly raised above the general surface.

The post-cornicular segments taper gradually and are much lighter, almost yellowish in colour.

The ringed antennae, cauda, rostrum, etc., are all like those of the apterous viviparous female.

Genital plate large and conspicuous, concave anteriorly.

Anal plate peculiar in being stumpy, not at all bilobed; even the bifid indication of the alate male is absent; it projects beyond the cauda. In front of it are four rudimentary gonapophyses. These are furnished with shorter but stouter spines than those of the anal or the genital plate.¹

The hind legs are conspicuous on account of their very much swollen tibiae, brownish-yellow in colour and covered over by numerous sensoria.

Eggs.—In mounted specimens the red bodies of the females show several eggs through the transparent skin, packed up even to the thoracic segments. All of them appear to be mature, of equal size and yellow. Several individuals that had not laid their eggs were dissected in chromacetic-acid which fixes them at the same time. The number of eggs in each was from 4 to 7; the average being 6. So many eggs are quite unusual in Aphids. Generally they have only one or two at a time and in most cases never more than one in their whole life, the egg invariably being of a large size.

¹ [Very likely the number of rudimentary gonapophyses in the oviparous female is 2, like that in the viviparous forms. I had no opportunity to study this sexual form myself. P. v. d. G.].

The eggs are oval, about twice as long as broad and sticky on one side, on account of the glue with which they are fastened down. They are yellow when first laid, but soon turn shining black. Length 0.5 or $\frac{1}{2}$ a millimetre.

The oviparous females can be observed in early January coursing up and down the branches, and often they wander a good deal with an egg sticking out through the genital aperture, before depositing it in any convenient place.

The young twigs of the Indian Elm are very tomentose and frequently the eggs are buried in the hairs; they may also be glued on to any roughened surface; small lenticels which appear about this time are sometimes chosen for the purpose. But the most favourite places are either small cracks in the bark or the ventral surfaces of any scales which cover the future shoots and happen to be sticking out. These eggs are quite bare and, so far as I have observed, no waxy flocculence is used to hide them from view, as noticed in the case of *Phyllaphis* (Weed, *Nat. Hist. of American Insects*).

Natural history and life-cycle.—After one or two winter rains, about the middle or the latter part of December, followed by cold winds and frosty nights in Lahore, the leaves of *Celtis* trees begin to turn yellow and slowly drop off. For the most part of January and February the larger trees are all bare and without foliage. At this time there are hardly any living Aphids present; only the eggs that are deposited by the oviparous females in January are to be met with after a careful search. In early March or even in the last week of February the plants begin to put forth their tender leaves and the Aphid eggs also hatch at this time. The young from these eggs are what are termed *stem-mothers*. They start the colonies and about the 10th or 12th of March one may notice these flocculent apterous females with a brood of four or five young, produced parthenogenetically. They resemble in all essential features the apterous viviparous females of later generations. After two or three generations, as the young develop into viviparous females and begin to reproduce actively, the winged females are produced. These are the *alate migrants* that fly off to other plants or to different parts of the same plant. They also give birth viviparously to apterous females, without the usual fertilisation. So that even in March we find plenty of alate and apterous females which multiply rapidly.

Habits.—These insects are extremely sensitive and with the slightest touch or shake of the leaf on which they are resting, they jump off and either fall to the ground or to a lower leaf or fly off. Only the very young specimens and those in the act of reproducing are disinclined to move.

Pink forms.—Most of the individuals at this time are of a greenish colour, with a brown or blackish tinge, though in April and May some pink-coloured forms are also to be met with. The size is very variable; one may find individuals hardly exceeding one millimetre in length, while others may be a little less than two.

Honey-dew is passed very copiously.

There is a marked decrease in their numbers in the second half of May and hardly any are to be seen on the lower branches of the trees in June. For the last three years I have not had the opportunity of staying in Lahore from June to Sep-

tember so have nothing definite to say about this period. I believe that they do not produce sexual individuals that would lay eggs and probably hide themselves in shady places. Not only is the heat very trying, but the flow of sap also is very scanty in the plants during this interval. The insect is no doubt present in the hills of the Punjab as I have collected it in July and August around Simla.

As the plants resume activity in the autumn for secondary growth about September, the plant-lice also become prominent. From September onwards through October and November wingless and winged females are produced in extremely large numbers. There is a preponderance of alate females and quite a large number of them as well as apterous females are pink-coloured.

Experiments.—A series of experiments were started with one Aphid on each young pot-plant, covered over by a lamp chimney with a piece of muslin tied over the top. A circular piece of white or black paper was spread over the soil to find out the number of moults, the skin being cast down each time. The pot was kept in a dish in which water was poured as desired for irrigating the plant from below. The whole arrangement is shown in the accompanying illustration.

The number of moults that each Aphid undergoes to reach the adult reproducing stage is four, and in pot plants they were spread over from 12 to 20 days. In nature I believe the period is shorter.

The apterous viviparous females under these conditions almost invariably gave birth to young ones which changed into alate viviparous females. The size of these laboratory specimens was usually smaller than those on the garden plants. Each individual lived upwards of forty and even fifty days. They become very inactive after about the middle of November.

Experiments were also arranged to find out when the true sexes were produced. Some of the pink pupae in December ultimately changed into small-sized males with black antennae and conspicuous genital armature. In the botanical gardens, under natural conditions, they appeared in the second half of November, and were fairly abundant up to the middle of December.

After this only a few isolated individuals were to be met with. At this time large numbers of apterous females turn red or scarlet and after December have their true characters well developed. They are the true oviparous females described above and chiefly cluster along the veins of leaves that are about to fall. In the last week of December and early in January there are large numbers of these oviparous females; an occasional winged male and a few apterous and alate viviparous females are also present.

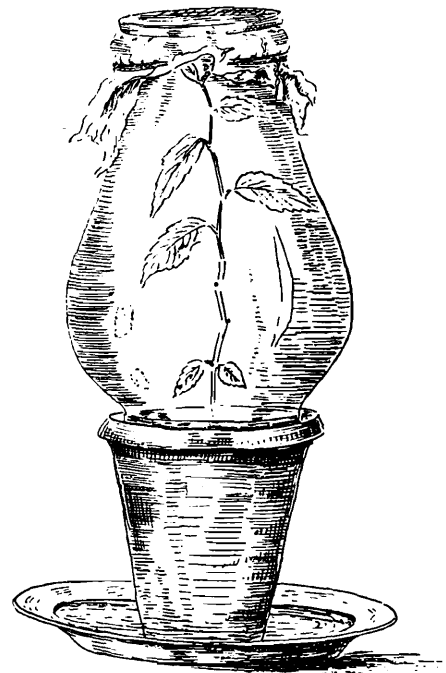


FIG. 4.—A seedling of *Cellis australis* under a muslin-topped chimney. The pot stands in a shallow dish of water and is irrigated from below. This American device is very satisfactory for studying the life-history of plant-lice.

The eggs are collected best in muslin bags tied over the whole twig containing these females with one or two males, but the latter apparently are not necessary. They can also be made to deposit their eggs in tubes. It is these eggs mainly that carry the species through the winter. In March they hatch into stem-mothers to start the new life-cycle.¹

Natural enemies.—*Chilomeles* is the worst enemy of this Aphid; it comes upon the scene almost simultaneously with the appearance of the insect in March. Both the larvae and the imagines actively devour the Aphid and the latter lay their yellow clusters of eggs freely near them.

This species, probably because of its active habits, is singularly free from the attacks of Syrphid larvae, and very few internal parasites have been bred from them. On one or two occasions I have obtained a Dipterous fly, not noticed as an Aphid parasite before by me, from their colonies. The woolly covering of the Aphid apparently serves as a good protection.

The life-history of another insect (*the Punjab Spotted Chrysopa*) has been worked out which seemed to feed actively on this Aphid but was not found common on others. It is a species of *Chrysopa*, but quite distinct from the common "Lace-wing" or "Golden eyes" which is abundant wherever plant-lice are to be had. It differs from the latter in its black eyes and mottled or spotted wings, besides other characters; it also does not carry the wings so vertically but rather flat or at a smaller inclination. The larvae are beset with strong lateral processes carrying bunches of radiating spines; the back of the larva is covered over with a heap of dry Aphids and Aphid wings that hides it as it moves forwards in a leech-like manner. The cocoon is also protected in a similar manner. It pupates for about ten or eleven days; the pupa (or nymph) after cutting out a circular lid in the spherical cocoon creeps out and either on the top of the cocoon or some distance from it moults for the last time to emerge as a delicate green insect with spotted gauzy wings.

It appears that there is only one species of *Chrysopa* so far recorded from the plains of India, figured by Lefroy in *Indian Insect Life*, pp. 154—157. We do not even know its specific name and Lefroy mentions it as *Chrysopa* sp.

The movements of the pupa before the final moult, which I have noticed even in this species, has apparently been overlooked at Pusa (Behar), where the life-history seems to have been studied and figured.

For the sake of future reference and for want of a better name we have been calling it in Lahore "The Punjab Spotted *Chrysopa*."

It has been figured among the insect enemies of Aphids.

Systematic.—According to the majority of the earlier and some of the recent authorities, e.g. Lichtenstein, Buckton, Ashmead, Gillette, the systematic position of this Aphid ought to be among the Lachninae. This sub-family of the Aphididae is

¹ [In connection with our knowledge of the geographical distribution of Aphididae, it is perhaps interesting to know that *Shivaphis celti* has been collected in Ceylon (Peradeniya) by the late Mr. Rutherford. P. v. d. G.]

distinguished chiefly by the antennae being six-jointed and by the sixth article bearing a small nail-like spur, the "processus terminalis," the latter could not be counted as a seventh joint as in the sub-family Aphidinae. It would in that case be placed very close to the genus *Phyllaphis* of Koch and *Ptychodes* of Buckton.

In common with *Phyllaphis*, it possesses wax-glands that secrete the woolly flocculence over the body, small pore-like cornicles, and antennal articles of the same proportional lengths. Winged males and apterous viviparous as well as oviparous females (the latter containing from six to eight eggs) are also present in both genera (*Phyllaphis* and *Shivaphis*).

The main points of difference are the well-developed cauda and the pigmented wings; the former is said to be obsolete and the latter plain in the case of *Phyllaphis*.

The resemblance to *Ptychodes* is as follows:—

- (i) In the wings, where the nervures dilate at their apices into triangular fuscous spots.
- (ii) In the deeply bilobed character of the anal plate, which is situated below a distinct though not quite similar cauda.

The differences to *Ptychodes* is that in *Ptychodes* there is no trace of wax-glands, the body instead being very pilose, the young specially so. The cornicles also are "buccinate" and all the parthenogenetic females are always said to be winged.

The Indian insect agrees with neither of these genera, nor have I been able to find any among the genera so far described in which it could be properly placed. It had, therefore, to be separated into a new genus, *Shivaphis*. It was fortunate in this connection that I was in a position to consult and also to have the agreement of a distinguished European student of Aphids.

In proposing the name *Shivaphis* for this insect, I have followed the lead of some of the distinguished naturalists who have carried out their investigations in this country. The Aphid is named after a chief Indian deity "Shiva," who is usually represented with long ash-gray hair flowing down his back, from amongst which the sacred waters of the Ganges take their origin. The long and white flocks of waxy material over the head and body of the insect does remind one of Shiva's hair, though the comparison between the Ganges and the copious honey-dew that the insect discharges may not be quite appropriate.

Shivaphis has further a systematic interest of its own, specially in view of the recent overhauling of the "classification of aphids" which even now can not be considered as quite satisfactory.

Buckton, as indicated above, was the first to establish a new genus (*Ptychodes*) for a walnut Aphid first described as *Aphis juglandis* (Frisch), and later transferred by Koch and Passerini to *Callipterus*. The short antennae, aborted spur, and some differences in the form and metamorphosis required in Buckton's opinion the creation of a new genus. But he has had little support from modern aphidologists and the species *juglandis* has been placed, with good reason no doubt, again in *Callipterus* with *Ptychodes* as a synonym.

In 1908 Mordwilko included *Phyllaphis* in his tribe Callipterina and in this he has been followed by van der Goot in 1913. But American authors like Ashmead, Gillette and Wilson do not seem to agree in regarding *Phyllaphis* as a Callipterine genus at all. The characters proposed for Callipterina by van der Goot in "*Zur systematik der Aphiden*" are as follows:—

- (i) Body bare, with short sting-like hairs or with long capitate hairs. *Wax-glands very seldom present.*
- (ii) Antennae seven-jointed; *very seldom six-jointed*; last joint scaly or with indistinct small corns; primary sensoria always and secondary very often with hair-rims.
- (iii) Cornicles very small, somewhat cone-like; *very seldom pore-like.*
- (iv) Cauda almost always "wart-like"; *seldom not or hardly constricted.* Anal plate often bilobed; rudimentary gonapophyses two.
- (v) Cubitus twice forked; tarsi with two "haftlappchen" ("hold lappets").

The Callipterini if defined in this comprehensive way would include *Phyllaphis* and for that matter *Shivaphis* as well. But the part of the definition relating to *Phyllaphis* is chiefly made up of characters that are more exceptional than normal. They are given in italics above. They evidently introduce an element of heterogeny into a group otherwise noted for its uniform nature. Most writers have thought so and among the most recent we may mention Wilson, *vide* his "Key and Synonyms of the genera in the tribe Callipterini (*Canad. Entom.*, XLII, 1910). Essig has followed him (*Pom. Coll. Jour. Ent.*, IV, no. 3, 1912).

The chief reason why *Phyllaphis* has not been recognised as a Callipterine genus seems to be that externally it had little in common with the Callipterinae, while with the Lachninae it agreed at least in having an aborted antennal spur and small cornicles. But it was probably placed there more for lack of any definite group to receive it than for any true affinity with *Lachnus*.

This point has been emphasised recently by Mordwilko and van der Goot, who have taken the same number of "rudimentary gonapophyses" and the presence of "haftlappchen" on the tarsi as the main grounds for grouping it with the Callipterine genera. For the aberrant characters the definition has been apparently stretched. That the views of Mordwilko and van der Goot are nearer the truth is strikingly proved by the discovery of the Indian genus *Shivaphis*. Along with many of its pronounced resemblances to *Phyllaphis* in the wax-glands, cornicles, etc., the possession of a bilobed anal plate and pigmented wings show a decided relationship with the Callipterinae.

But it still seems very hard to imagine that genera like *Phyllaphis* and *Shivaphis* could possibly have originated from Callipterine ancestors. Even if we leave aside other characters, there is little parallel or justification in regarding a replacement of sting-like hairs in one by wax-glands in the other as of minor importance and of conceivable occurrence in the same sub-family.

In my opinion, now that we have at least two genera, they have every claim to be recognised as forming a separate group or a subgroup of their own. It would be

near Callipterina of course, but distinct from it and in no way connected with Lachnina. It might for the present be called Phyllaphidina and defined thus:—

Body furnished with rows of "gland-groups" secreting a flocculence of a waxy nature.

Antennae six-jointed; the sixth article bearing a rudimentary "processus terminalis" or spur.

Cornicles small, pore-like, hardly rising above the level of the body.

Cauda scarcely constricted.

Wings plain or pigmented.

Rudimentary gonapophyses in viviparous females two in number (oviparous females in *Shivaphis celti* have four).

Other characters much as in Callipterina.¹

***Tuberolachnus viminalis* (Fonsc.) Mordw.**

Hosts.—*Salix tetrasperma*; *Salix aegyptica* (*Bed-mushk* or Scent willow); *Salix* sp.

Synonyms.—*Lachnus viminalis* (Fonsc.), *L. dentatus* (Le Baron) and *L. fuliginosus*, Buck.

Literature :—

Buckton, *Mon. Brit. Aphids*, II, pp. 53—57, 1887 (gives description and previous literature).

Essig, *Pom. Coll. Jour. Ent.*, IV, No. 3, pp. 774—789, 1912 (a complete bibliography with excellent description and plates).

Wilson, *Ann. Entom. Soc. America*, IV, p. 53, 1911 (notes on synonymy).

This is the largest Aphid of the plains, possessing characteristic facies which render its recognition very easy. In every respect it is identical with the insect as met with in Europe and America, but seems so far to be unrecorded from Asia. The larger branches of *Salix* trees are covered over in patches of several inches in length with

¹ [The genus *Shivaphis*, Das, is a very remarkable one, but it does not deviate so much from other Callipterinae as Mr. Das thought. Indeed, in my opinion, this genus forms a very interesting and hitherto missing link between the bulk of true Callipterinae and the somewhat aberrant genus *Phyllaphis*, Koch.

From all true Callipterinae *Shivaphis celti* shows the greatest resemblance to "*Ptychodes*" *juglandis*, Frisch (sub *Pterocallis* by v. d. Goot). But whilst in *Pt. juglandis* the aborted spur is still about half as long as the base of the ultimate joint, in *Shivaphis celti* its length is much more reduced, to about $\frac{1}{4}$ the length of the basal part of joint VI. The caudal parts and wings in both species are nearly similar. The cornicles, although smaller, in *Shivaphis* still distinctly show above the level of the body; they are somewhat conical, not pore-like as Mr. Das shows them to be. The presence of wax-glands in *Shivaphis celti* does not separate it from other Callipterinae, as Mr. Das thinks, since we find such glands in some other true representatives of this tribe, such as *Euceraaphis betulae*, Koch, *Subcallipterus alni*, Fabr. (♀) and *Pterocallis tiliae*, L. (♀).

The principal character of *Shivaphis* in common with *Phyllaphis* is the smallness of the spur; other common characters, as mentioned by Mr. Das, are of little or no importance.

I do not think that the discovery of *Shivaphis celti* should necessitate the creating of a new separate tribe next to Callipterina. The discovery of *Shivaphis* gives us one more very valuable contribution to our knowledge of the Callipterina, showing that the genus *Phyllaphis* does not indeed deviate very much, but is connected by some intermediate forms to the bulk of typical Callipterinae. P. v. d. G.]

countless young and adults sitting compacted together, all facing in one direction. Very frequently the insects wave their long hind legs in the air, either to ward off enemies or for the sake of pleasure as they do it even when there is nothing to fear. The discharge of honey-dew is very copious, drenching the lower leaves and branches and later congealing into solid sugar which does not crystallise.

A very thorough account of its external anatomy, with fine illustrations; is published by Essig (1912) so that no further account is given here.

The most outstanding features are its large size and grayish-brown colour, as shown in the figures; a prominent black dorsal tubercle situated between and a little in front of the equally conspicuous cornicles, and present in all stages of life; rows of black spots on the back; hind legs and rostrum very long, the latter in newly born individuals reaching beyond the abdomen; sensoria in one line on the antennae of the alate female; wings large, hyaline and carried normally; body and cornicles covered with fine hair; cauda obsolete.

In California, according to Essig, winged females are rare, but this is not so in Lahore; the vast majority of them in February are alate, while very few are apterous. It is also said to be free from the attacks of predaceous insects in other countries, but this is not true in the Punjab. Several Coccinellids and the larger Syrphid larvae attack it, but not so much as other species of Aphids.

The earliest date for its appearance in Lahore is late in December or in January. Only apterous females are found then; about the last week of February all forms are abundant in the botanical gardens outside the city as well as on willows near the Ravi.

No appreciable injury is inflicted on the larger trees. The pest therefore has little or no economic importance in the West, but in Lahore it also occasionally attacks the delicate *Salix aegyptica*, the scent willow, vernacular "bed-mushk," which is cultivated for the sake of its male catkins. From these are extracted a "bed water" (*arg bed-mushk*) and a "bed essence" (*ruh bed-mushk*), both of which are officinal in the Indian systems of medicine and very much in demand during the summer. The nature of the attack on these male plants (females are not known) seems never to have been very serious so far, but it might just as well be considered as a possible source of danger, hence the economic value of this otherwise more or less harmless Aphid.

In earlier literature the Aphid has been referred to the genus *Lachnus*, but, in view of the presence of dorsal and lateral tubercles coupled with slight differences in wing venation, Mordwilko (1909) has separated it into his new genus *Tuberolachnus*. This procedure has been justified by Wilson (1911) on the grounds of priority as well.

In 1891, from the Indian Museum, Calcutta, some Aphid material in alcohol was forwarded to Buckton with the information that the insect "infested peaches and apricots in Quetta (Baluchistan) and caused their bleeding." Considering it to be a distinct species and naming it *Lach. fuliginosus*, Buckton published a very poor description with worthless plates in *Ind. Mus. Notes*, II, no. 1, p. 40. The chief point of difference that he notices is in the form of the pupae of his new species from that of

Lach. viminalis of the willow. Buckton says that a dorsal horn-like process is present in the former, while in the latter "it is restricted to the apterous female." This is a mistake as the tubercle in *Lach. viminalis* is present in all stages; Buckton was evidently misled by the name of the wrong host being supplied to him.

I have had the opportunity of examining a part of this material in Calcutta and I found that in the same phial were also included a few apterous and young females of a peach Aphid, described below as a *Tuberodryobius*, which is altogether a different insect. I have therefore placed *Lach. fuliginosus* (Buck.) among the synonyms of *Tuberolach. viminalis*.

***Tuberodryobius persicae* (Cholodk.)¹**

(Clouded Peach-stem Aphid.)

(Vernacular, Aru ka Tela).

Hosts :—

- (1) *Prunus persicae* (peach).—Vernacular, Aru.
- (2) *Prunus communis* or *domesticus* (plum).—Vern. Alucha.
- (3) *Prunus armenica*.—Vern. Khurmani.
- (4) *Prunus amygdalis* (almond).—Vern. Badam.

Distinguishing characters.—One of the largest Aphids of the plains, infesting the main trunk and branches of the fruit trees named above, more particularly the peach. Big patches numbering thousands of individuals cover the branches in lengths varying from a few inches to yards. If one stands beneath an infested branch the "honey-dew" falls like a gentle shower of rain, trickling along the lower parts of the plant it gives it an oily appearance; the plant later turns black from the growth of a sooty fungus (*Capnodium*). The vegetation below is quite smothered and blackened. Numerous ants, bees, flies, wasps and other "honey-seeking" insects gather about these trees which are conspicuous from a distance in early winter and spring.

The apterous insects are variegated in colour, to the naked eye appearing like small castor-oil seeds; the colours are grayish-white and dark reddish or pitch black intermixed.

The most prominent parts are the two rows of median dorsal tubercles, two very large conical and black cornicles and many black spots in rows. The mesothorax is covered with whitish pulverescence and similar gray areas are noticeable in front and behind the cornicles. The small antennae, long red-brown legs, silvery white ventral surface showing a huge rostrum in the middle, rather slender wings with deeply pigmented black areas are all characteristic.

¹ [Mr. Das having apparently forgotten to give a summary of the characters of his new genus *Tuberodryobius*, I will for completeness sake add it here.

Genus *Tuberodryobius*, Das. (Type : *Lachnus persicae*, Cholodk.).

Morphological characters. Body large, pilose, with 2 rows of distinct dorsal tubercles on the 6 foremost abdominal segments.

Other characters are similar to those of *Pterochlorus*, Rondani. P. v. d. G.].

MORPHOLOGICAL DESCRIPTION.

Apterous viviparous female.—Body ovate or pyriform, in fat specimens somewhat flask-like; thick and rounded behind about the region of the cornicles, gradually narrowing towards the head.

The prevailing colour is variegated black and white.

Head quite black, bearing one white spot about the middle of the posterior edge; twice as broad as long. On either side of the median line there are two slight elevations with radiating hairs placed upon small tubercles. The front is flat and hairy.

Eyes black, with very small ocular tubercles.

The antennae rest directly upon the head; the basal two articles concolorous with the head; the proximal halves of articles III, IV and sometimes of V reddish-brown, the rest black. There is a slight curvature beyond the basal two joints; the last segment is swollen and bears the nail-like spur. On the whole the antennae are short, about one quarter the length of the body; tuberculate hairs are scattered over the surface.

Length proportions :—

	III.	IV	V.	VI.
	30	15	14	7+4
Lengths	0.50	0.25	0.24	0.12+0.07(=0.19) mm.

Sensoria.—From 3 to 5 large sensoria are found on the distal quarter of the 3rd article and from 1 to 3 on the 4th. One primary sensorium on the 5th and another with a few more scattered around it on the 6th. The hair-rims are not distinct in any.

Prothorax well defined, somewhat rectangular; it bears two L-shaped broad bands, the transverse limbs on which are longer and meet at their ends a black rounded elevation beset with hairs, near the posterior angles; the other limbs are shorter, slightly converging towards the middle of the anterior border. Between them they enclose a mealy triangular spot, the base of which is the middle of the posterior border; the latter bears two more smaller white spots.

In the angles of these bands, which face outwards, there is one white spot, the centre of which is occupied by another black hairy spot. On the pleurae, *i.e.* the lateral side just above the coxae which are ventral, there is a distinct lateral tubercle.

Mesothorax separated from the prothorax by a black line extending over the anterior border; at its ends near the lateral edge it bends at right angles into an elongated, hairy black spot on either side. There is a very large pair of black dorsal tubercles, somewhat flattish and hairy; each bears in front one black spot and another on the dorsal space which is grayish-white. The pleurae are very dark black and even encroach upon the dorsal surface. On the groove behind there is another spot behind the latero-dorsal one on each side.

Metathorax similar to the mesothorax, so far as the tubercles and spots are concerned. The dorsal tubercles, one on each side of the median line, are smaller;

the tubercles near the lateral edge are very small and represented by a few hairs; the rest of the dorsal surface is covered over by the whitish pruinose secretion and forms a conspicuous band or white area.

Both of these thoracic segments bear conical lateral tubercles, situated a little above the coxal membranes of the leg joints. The groove behind has four spots upon it, two median and two latero-dorsal which are larger.

Abdomen globular or ovate, thickest about the cornicles; it is exactly bilaterally symmetrical and is made so by a mealy line which runs longitudinally in the mid-dorsum and can even be traced over the thoracic segments, up to the head. Immediately on either side of it, each abdominal segment carries a conspicuous black projection—the “dorsal tubercle,” surrounded at its base by a concolorous circular spot and beset with short radiating hairs. Near the lateral edge there is another flattish tubercle with similar hairs, which might be termed the “dorso-lateral” tubercle. Just on its outer side there is one black spot.

Upon the groove, which divides two consecutive segments, are placed six black round spots; one pair in front of the “dorsal tubercles,” and one pair on either side in the space between these and the dorso-lateral tubercle. The spots are quite black, with a round depression in the centre; after treatment with caustic potash it is this depression which remains black, the rest becoming bleached.

The first three segments are quite like each other; on the fourth the dorso-lateral tubercle is very small and upon the fifth and sixth it is represented by small spots only, over which a blackish broad band runs backwards and outwards from the cornicles to the lateral border. In all other respects these segments are similar, but the dorsal tubercles of the seventh segment are very large and transversely flattened and apparently confluent with the 7th dorso-lateral tubercles. On the eighth segment they are alike but smaller.

Pattern.—The pattern, therefore, consists of two *dorsal* rows of tubercles and two *dorso-lateral*. Of the spots there are eight longitudinal rows, two dorsal, four dorso-lateral and two almost lateral. In addition to these, each ring of the abdomen carries a prominent lateral tubercle situated on the carinae with spots alternating with the tubercles.¹ The ultimate segment is telescopic and forms a ring encircling the cauda and the anal plate.

Cornicles large, black, truncated cones; their bases are very broad and surrounded again by black basal areas, which occupy a considerable portion of the dor-

¹ [The description of the arrangement of tubercles, etc., as given by Mr. Das, is in my opinion not fully correct.

We find 2 spinal (= “dorsal”) tubercles on the dorsum of the mesothorax, metathorax and the abdominal segments 1–6. On segment 7 and on segment 8 there are two large, oval, chitinous “pleural” plates, but no “tubercles.”

On the margins of the abdominal segments 1–3 there is visible on either side a chitinous rounded plate, which in my opinion cannot be termed a “tubercle” (= “dorso-lateral” tubercle of Mr. Das).

The “prominent lateral tubercles situated on the carinae”, as mentioned by Mr. Das, I have not been able to discover. Perhaps Mr. Das may have mistaken the large stigmata for them? P. v. d. G.]

sum on the fifth abdominal ring and encroach upon the fourth and the sixth as well. Over the surface there are numerous hairs and the truncated end is bounded by a rim, across which is stretched a white membrane. Upon this membrane lies another black incomplete ring. The diameter at the apex is about one-third of that at the base. The secretion from the cornicles is dirty black.

The cauda is a flattened semicircular plate with its posterior convex edge much thickened, black and strongly spiny; it is attached by its broad base and does not project much beyond the body.

Anal plate below large, broadest in the middle; black and spiny like the cauda.

These two structures bound the anus, which is a large opening facing postero-laterally. The clear drops of limpid "honey-dew" exude at this place and are thrown off at very short intervals of time.

Genital plate smaller, somewhat elliptic in form; it forms the anterior boundary of the genital aperture. In colour and spinose character it resembles the anal plate.

Three rudimentary gonapophyses are to be discerned as faintly marked small processes, with a few spines to each.

The ventral surface in living specimens is silvery white on account of its pruinose character. The colour otherwise is dark purple, due chiefly to a similar tinge of the body juices. Near the lateral edges on either side runs a row of large black spots.

The legs are remarkable for their length; the hindmost are the longest and proportionately longer than in most other Aphids. The colour is shining orange or reddish-brown, with some parts pitch black.

In the hind legs the coxae, their membrane, a small patch to the outer surface of the femora, the femoro-tibial joint, the ankle and tarsi are quite black. Most of the femora and tibiae are orange brown, the later shading into a darker colour. The tibiae are a little less than double the length of the femora and are a little curved towards their distal half as shown in the camera drawing.

Tarsus.—There are no sole-pustules present on the tibial points; the first joint of the tarsus is about one half the length of the second; the latter is furnished with two stout claws. The other legs are shorter but similarly coloured; on the middle of the femora they bear a complete ring of black which may sometimes extend very near to the coxae.

The rostrum is remarkable for its length; it reaches much beyond the level of the third coxae, often up to the level of the cornicles and even further in thinner specimens. The longest article is brownish in colour, while the last two are black and subequal. The three setae that may be seen in the ventral groove are very long, while the labrum at the base is a well-developed, narrow, triangular piece, overhanging the setae. The rostrum in the new-born young is proportionately much longer and projects like a tail from the ventral side of the body end.

The face is shining black, elevated from the middle of a depression, bounded by a mealy ridge which runs on its anterior and lateral sides as a white line.

The measurements on an average are as follows:—

Body	4.0 × 2.2 mm.
Antennae	1.40 mm.
Hind leg	5.35 „
Cornicle (base)	0.46 „
„ (apex)	0.15 „ in diameter.
Cauda (length)	0.20 „
„ (breadth)	0.41 „

Alate viviparous female.—Head deep black, comparatively large, about as broad as long, bearing pitchy black eyes with ill-defined ocular tubercles. On the sides of the dorsum are two hairy elevations which mark out a central rectangular area that is somewhat depressed.

The median ocellus is placed rather ventrally, a little above the lower edge of the front, that runs like a hood on the sides and in front of the face, forming a white mealy border.

Antennae comparatively short; in living specimens perfectly black. In length the proportions are the same as in the apterous female; article III is the longest, about equal to the two following taken together, which are of the same length, about one and a half times the 6th.

Sensoria large, without very distinct hair-rims either on the secondary or primary ones. Their number on article III is about fifteen, while four or five are present on IV.

The prothorax is clearly marked off and shows a broad band over its anterior half, somewhat constricted in the middle as shown in the drawing. The lateral tubercles are placed over the posterior angles.

The mesothorax is shining black, with broad muscle-bosses; its anterior edge projects into a black peg-like process that goes beneath the prothorax into a triangular concavity.

The metathorax forms a broad convex band, similar in colour to the mesothorax and bounded externally by the dark brown insertions of the hind legs.

Wings.—Anterior pair rather short, well rounded and narrow in width. On distended large viviparous females they look much smaller and out of proportion. They seem to be seldom used for flight; when disturbed, the insect trusts to its legs more than its wings. In fact it is very rare to catch this Aphid on the wing. They are further characterised by being deeply pigmented with black which often shines like jet. The disposition of the pigment is shown in the camera drawing.

The stigma is long, black, lighter towards the centre. There is a big black patch along the first oblique vein, occupying largely the space between the first and the second oblique vein; the next cell contains a small area near the hind margin. Most of the space between the stigmal vein and the cubitus, with its two forks, is pigmented, except a small triangular area behind the stigma; near the margin, between two consecutive veins, are noticeable blotches of deeper black, six in number, beginning with the one just in front of the stigmal vein.

The hind wings are hyaline, with two oblique veins; the subcostal along its

anterior edge is pigmented as a distinct band. All the veins are striated transversely and, except the patch along the first oblique in the forewing, the pigmented parts and the margins bear complete or incomplete hexagonal figures, raised above the general surface on both sides. These are imbricated one above the other.

The abdomen is somewhat oval, not so broad as long, like that in the apterous viviparous female, with which in other respects it exactly corresponds; the lateral, dorso-lateral and dorsal tubercles are disposed in the same manner, as are also the rows of spots between them.

The cornicles, like the abdomen, are slightly smaller than those of the apterous female; they are covered over by scattered hairs upon tubercles. Upon the membrane stretched across the mouth a black incomplete ring is prominent and characteristic.

The cauda and anal and genital plates are similar.

Legs reddish-brown; coxae, a ring on the femora, knees and tarsi black; they are only a little longer than those of the apterous viviparous female.

Rostrum large, extends much beyond the hind coxae, almost to the level of the cornicles and even beyond.

The measurements on an average are:—

Body	3.50 × 1.65 mm.
Antennae	1.50 mm.
Wing expanse.	9.20 „
Wing	4.22 × 1.48 mm.
Cornicle	0.20 × 0.41 mm., base 0.45 mm., apex 0.15 mm. in diameter.
Cauda (length) about	0.20 mm.

The alate females that are produced in December and January are smaller in size than those developed earlier. Their bodies are much attenuated and therefore the wings, which are deeper black, appear comparatively long, extending much beyond the apex of the abdomen. They look very much as if they were males, but they lack their genital armature and by opening up the abdomen one always finds the ovarian tubes containing immature embryos of various stages.

These females seem to be the product of malnutrition, the flow of sap in the plants at this season being at its lowest. Most of them die without ever giving birth to a single young.

Apterous oviparous female.—The apterous females that lay eggs appear in early January and are remarkably similar to the apterous viviparous females in external anatomy. There appear to be present in this case hardly any secondary sexual characters, which in other Aphids distinguish the oviparous from the viviparous female. Neither is there a change in colour or pattern or any difference in the posterior abdominal segments observable. Sensoria on the hind tibiae are entirely lacking.

There may be a little more duskiess on the legs and a slightly greater curvature of the antenna near the basal part of the third article. The sensoria are not so well

marked and their number is often restricted to only two or three, besides the primary sensoria on the fifth and sixth article.

They are recognised if one catches them either ovipositing or carrying about an egg which is protruding, or by opening up the abdomen under a strong lens or a binocular. The ovarian tubes are then seen to contain eggs in place of immature embryos. These are packed inside the body right up to the mesothorax; the number is about a dozen in each, but it was found to vary from about 10 to 15 in the specimens dissected.

Abnormalities.—In some cases I have also obtained a few embryos along with the usual or a smaller number of eggs. A similar oviparous and viviparous character of the females has been noticed by Hunter in *Toxoptera graminum* (Rond.) (*Kansas Univ. Bull.*, No. 2, 1909), but probably if further investigated it would be found to be the case in a much larger number of Aphids. Another uncommon variation is a stumpy oviparous or viviparous female, very much similar to the alate female in appearance, but with rudimentary or no wings. A still more unusual form is met with in the "short-beaked" specimens. These also may be either oviparous or viviparous females. The rostrum is so small that it hardly reaches beyond the second coxae, and is even less than half the length of that of a normal individual. It is the first joint that is reduced, otherwise the beak is quite complete in all respects.

The true males have so far escaped my observation, but they may be expected to be alate and not very different from the winged females. In other species of *Dryobius* they are said to be slender insects with well-developed genitalia, a sickle-shaped penis forming a conspicuous element in the centre.

The eggs are generally laid in large clusters, each cluster containing several hundreds; smaller clusters are also found but frequently the eggs are scattered singly, particularly those laid during the latter part of January. Each oviparous female contains about a dozen eggs. There are seldom more than this number but frequently less; 8 to 10 usually. The eggs are shining black, oval bodies. The laying period commences in December and continues in some cases up to the beginning of February. The last date of my collection is 25th January.

The life-history can be summed up briefly. The eggs hatch in March, with the flowering of the peach, some days previous to the forming of leaves. These stem-mothers give birth to wingless females. There are from 2 to 4 generations of the latter before any winged ones are produced. They reproduce at quite an extraordinary rate. Five apterous viviparous females, colonised on two peach trees in December, kept up a steady rate of progress in January, February and the middle of March, but only a patch or two of a few hundred specimens was all that resulted from them. During March and April, however, there was no limit to their numbers. All the larger branches from the bottom upwards were quite covered with them. The trees looked as if bathed in oil; the black smothered grass and dry twigs beneath the branches were sticky with the half dried "honey-dew." These twigs readily take fire as if immersed in inflammable material.

The above experiment proved at the same time that the winter can be passed in

a viviparous condition if circumstances are favourable and the weather mild and rainless.

In May their numbers are always very considerably reduced, while in June one has to search a good deal before finding an isolated group of a few individuals. As the egg-laying period in this species is spread over a considerable time and the oviparous females do not in any material respect differ from viviparous females, it is likely that some eggs are deposited even at this time. These again hatch out in September and the insects are abundant afterwards. Some apterous viviparous females may also live through the summer. The sexes are produced in November and December and the eggs are laid about the same time.

Enemies.—All the larger Coccinellids and Syrphids abound on the branches of infested trees and feed on them freely, without appreciably reducing their numbers. The worst enemy they encounter is the exigencies of the weather. After a few clear days of strong heat one suddenly finds that the insects have completely disappeared, leaving only their skins sticking to the leaves and branches as reminiscences of their presence.

Loss.—The loss to the peach crop from the attack of this Aphid is immense. Very few fruits mature and attain the normal size and colour on infested trees. It is rather strange that the attention of the Agricultural Department has never been directed towards estimating and remedying the actual loss. Neither are any preventive measures adopted to eradicate the pest by the peach growers. The only remedy occasionally resorted to, when it gets too menacing, is to employ boys to rub them off with handfuls of ashes. This affects a temporary relief only as even if a few escape death they multiply again very quickly.

Historical and systematic.—The “Peach-stem Aphid” has probably been here for ages, and is known to the people as “Aru ka Tela”; there is nothing to indicate that it was imported from elsewhere. The only other places where it has been definitely collected are Baluchistan and Palestine.

The first European to take any notice of the insect was Mr. Elliot in Quetta (Baluchistan), who observed apricots being attacked very seriously and remarked that the trees bled profusely as a result. As a matter of fact it was only the “honey-dew,” the excreta of the Aphids coursing down the stems. Whatever else he noted was quite correct and referred to this insect. He sent specimens to the Indian Museum in Calcutta for identification in 1890, and probably at the same time sent some more Aphids amongst which might have been specimens of what is now known as *Tuberolachnus viminalis* (Fonsc.) on willows. On the other hand it is also likely that there may have been some mixing up of the peach and *Salix* Aphids in Calcutta. I have examined this material in the Museum, and it is a part of what was sent to Buckton for examination. I found very few individuals of the peach Aphid and only apterous forms, the rest being *Tuberolachnus viminalis*, both alate and apterous. Both are labelled “On Peaches, Quetta.”

Buckton treated the material as one, naming it *Lachnus fuliginosus*, Buck., a new species, and published a description in *Indian Museum Notes*, vol. II, no. 1, p. 41,

1891, that applies chiefly to *Tuberolachnus viminalis*. He remarked on the close similarity of the two forms, but was mistaken in saying that the characteristic dorsal process of the *Salix* Aphid is confined to the apterous viviparous female, while in the case of the Quetta Peach Aphid it is present in all stages. The obscure illustrations that accompany the description have apparently been drawn from the *Salix* Aphid. Buckton, therefore, was only redescribing *Tuberolachnus viminalis*, although he may have seen some apterous specimens of the real insect on peach, originally sent by Elliot. On this account Buckton's name *Lachnus fuliginosus* appears as a synonym of *Tuberolachnus viminalis* and the peach aphid is left without a name. After comparing the Calcutta material and sending for the insect from Quetta and also satisfying myself that no other reference to it was on record in the literature available in India, it was decided to give it a new name in our laboratory.

Recently, however, a short paper has come under my notice, published in 1912 from the Natural History Museum, Hamburg, by P. van der Goot and styled "Über einige Wahrscheinlich neue Blattlausarten." In it a rather brief and in some respects incomplete account has been given of the salient features of the morphology of this insect, from alcoholic material, collected from almond branches in Palestine. He has called it *Dryobius amygdali*, n. sp. On referring to van der Goot it has further been brought to light that the same insect is supposed to have been described before as *Dryobius persicae* by Cholodkowsky from some part of Russia. I have not been able here to trace the publication containing Cholodkowsky's description, but the fact is mentioned on the authority of Mordwilko. I have, therefore, adopted Cholodkowsky's name, which is really quite appropriate, and I have furnished in these pages a rather detailed description of the various forms of the insect.

The generic position of this insect is somewhat doubtful. The long legs, short antennae and pigmented wings, in common with the habit of laying eggs in clusters, have a strong resemblance to the species of *Dryobius* on oak, etc. But the latter are totally devoid of any tubercles either on the dorsum or on the lateral sides. It is really this character, more than any other, that has been considered by Mordwilko of sufficient importance to warrant the separation of *Lachnus viminalis* into a new genus (*Tuberolachnus*) from the original *Lachnus*. The peach and the *Salix* Aphid possess these characters in common, besides others of minor importance, but their wings are quite different; in the former they are deeply pigmented and in the latter clear and hyaline.

Thus we have *Tuberolachnus* differing about as much from *Lachnus* as the peach *Dryobius* from the type of that genus (*D. roboris*). I have therefore for the present accepted Mr. van der Goot's suggestion of calling it *Tuberodryobius*, even at the risk of forming a new genus for a single species.

It may at the same time be mentioned here that as the genera *Lachnus* and *Dryobius* are not very sharply defined from each other, except in the case of the alate female, they might at some later revision be amalgated. It would also not be very wrong to keep *Tuberolachnus viminalis* and this peach *Tuberodryobius* in one genus, if too much importance is not attached to the pigmentation of the wings. They both

possess similar habits of grouping themselves into patches, and sticking out their long hind legs into the air at the same time and in the same direction.

HOST-INDEX OF THE APHIDIDAE (PLANT-LICE) OF LAHORE.

In the following pages is given a host-index for the Aphids collected by me in the neighbourhood of Lahore; the names of the plants, in alphabetical order, are placed on the left side of the page and against them are noted those Aphids known to infest them. The time of the year when they were observed has also been indicated in most cases.

This index from its very nature must be incomplete and only provisional. It covers a very limited area and there is no reference in it to the numerous hill species, as yet entirely unworked. Therefore, the only justification for preparing it is the entire absence of any other, and yet to a certain extent it forms a fair representative for the plains in other parts of India as well. I hope it will be of some use to those who take up the study here or elsewhere in this country, and with that view the common vernacular names of plants, and in some cases their English equivalents, have also been included in the index.

PLANTS.	APHIDS.	DATE.
<i>Abutilon indicum</i>	<i>Aphis malvae</i> (Koch)	} Novr. and Feb.
<i>Abutilon</i> sp.	(i) <i>A. gossypii</i> (Glover)	
	(ii) <i>Aphis malvoides</i> , n. sp.	
<i>Ageratum conyzoides</i>	(i) <i>Brachycaudus pruni</i> (Koch)	March to August.
	(ii) <i>Myzus persicae</i> (Sulz.)	May.
Ak (see <i>Calotropis</i>).		
<i>Althea vasea</i> (khatmi)	<i>A. malvae</i> (Koch)	Feb.-April.
	<i>A. gossypii</i> (Glover)	
<i>Alhagi manrorum</i>	(i) <i>Macros. pisi</i> (Kalt.)	March.
	(ii) <i>A. medicaginis</i> , Koch	March.
Alucha (see <i>Prunus armenica</i>).		
<i>Antirrhinum</i> sp.	<i>Myzus persicae</i> (Sulz.)	March.
Apple (see <i>Prunus malus</i>).		
Aru (see <i>Prunus persicae</i>).		
<i>Arundo donax</i>	<i>Hyalopterus pruni</i> (Fabr.)	Feb., March-May, Sept.-Novr.
<i>Avena sativa</i>	(i) <i>A. maidis</i> (Fitch)	Oct.-March.
	(ii) <i>Siphocoryne avenae</i> (Fabr.)	Novr.-March.
	(iii) <i>Macrosiphum granarium</i> (Kirby)	Novr.-March.
	(iv) <i>Toxoptera graminum</i> (Rond.)	Feb.-March.
Asgand (see <i>Withania</i>).		
Bakla (see <i>Vicia faba</i>).		
Bathu (see <i>Chenopodium alba</i>).		
<i>Beta bengalensis</i>	<i>Myzus persicae</i> (Sulz.)	Feb.
Bhakhra (see <i>Tribulus</i> sp.)		
Bhang (see <i>Cannabis sativa</i>).		
<i>Bongainvillia</i> sp.	<i>A. medicaginis</i> , Koch	Novr.-Decr.
	<i>A. malvoides</i> , n. sp.	Novr. (very occasional)

PLANTS.	APHIDS.	DATE.
Bhindi (see <i>Hibiscus esculentis</i>).		
<i>Brassica campestris</i> (toria or taramira).	(i) <i>Siphocoryne indobrassicae</i> , n. sp. (ii) <i>Myzus persicae</i> (= <i>Rhopalosiphum dianthi</i>). (iii) <i>Brevicoryne brassicae</i> (Linn.)	Oct. to Feb. Augt. to Oct. Feb.-March.
<i>Brassica juncea</i> (mustard)	Do.	Oct.-Feb.
<i>B. rapa</i> (turnip)	Do.	Do.
<i>B. oleracea</i> (cabbage)	Do.	Octr.-June.
Brinjal (see <i>Salanum melongium</i>).		
Bed (see <i>Salix</i> sp.).		
<i>Bryophyllum</i> , sp.	<i>Myzus persicae</i> (Sulz.)	Feb.-March.
Cabbage, cauliflower (see <i>Brassica</i> sp.).		
<i>Cajanus indica</i>	<i>Aphis medicaginis</i> , Koch	Novr.-Jan.
<i>Calotrophis gigantea</i>	<i>A. nerii</i> (Boyer)	Feb.-Mar.
<i>C. procera</i>	Do.	Aug.-Oct.
<i>Carthamus oxycarpa</i>	<i>Brachiunguis carthami</i> , n. sp.	May and June.
<i>Capsella bursa-pastoris</i>	(i) <i>Myzus persicae</i> (Sulz.) (ii) <i>A. gossypii</i> (Glov.)	Feb.-Apr.
<i>Cannabis indica</i> (or <i>sativa</i>)	<i>Phorodon cannabis</i> , Pass.	Oct.-Dec.
<i>Carum carraway</i>	<i>Brevicoryne coriandri</i> , n. sp.	April.
Carrot (see <i>Daucus carota</i>).		
Chari (see <i>Sorghum</i>). ¹		
<i>Celtis australis</i>	<i>Shivaphis celti</i> , n. sp.	March, May, Sept.-Dec.
<i>Chenopodium alba</i>	} <i>Brevicoryne chenopodii</i> (Schr.)	Dec.
<i>Chenopodium</i> sp.		
<i>Cheiranthus cheiri</i>	(i) <i>Siphocoryne indobrassicae</i> , n. sp. (ii) <i>Myzus persicae</i> (Sulz.)	Feb., Mar. Apr.
<i>Chrysanthemum sinense</i> (cultivated)	(i) <i>Macrosiphum sanborni</i> (Gill.) (ii) <i>A. malvoides</i> , n. sp. (iii) <i>Stephensonia lahorensis</i> , n. sp.	Sept., Jan., Mar., Apr. Oct., Jan., March.
<i>Centaurea</i> sp.	<i>Aphis rumicis</i> , Linn.	Dec.
<i>Citrus aurantii</i>	<i>A. malvae</i> (Koch) <i>A. malvoides</i> , n. sp.	Oct.
<i>Citrulus vulgaris</i> (tartmz)	(i) <i>A. malvoides</i> , n. sp. (ii) <i>A. gossypii</i> (Glov.) ?	Jun.-Sep.
<i>Cinannaria</i> sp.	(i) <i>Myzus persicae</i> (Sulz.) (ii) <i>A. malvae</i> , (Koch)	Feb., Apr. March.
<i>Clianthus puniceus</i> or <i>damperii</i> (parrot's beak).	<i>Macrosiphum pisi</i> (Kalt.)	April.
<i>Cnicus arvensis</i>	(i) <i>A. rumicis</i> , Linn. (ii) <i>Phorodon cannabis</i> , Pass.	Nov., Mar.
<i>Colocasia antiquorum</i> (or <i>esculentis</i>)	(i) <i>Aphis durranti</i> , n. sp. (ii) <i>A. malvae</i> (Koch)	Oct., Dec. Oct., Dec.
<i>Convolvulus majus</i>	<i>Myzus persicae</i> (Sulz.)	Feb., Apr.
<i>Coronopus didymus</i> —	(i) <i>Myzus persicae</i> (Sulz.) (ii) <i>Siphocoryne indobrassicae</i> , n. sp.	Dec., Apr. Feb.
Cotton (see <i>Gossypium</i>).		
<i>Coriandrum sativa</i>	<i>Brevicoryne coriandri</i> , n. sp.	Mar., Apr., Dec., Jan.

PLANTS.	APHIDS.	DATE.
<i>Crotalaria juncea</i> (san)	<i>A. malvae</i> (Koch)	Nov., Dec.
	<i>A. malvoides</i> , n. sp.	
<i>Cryptostegia grandiflora</i>	(i) <i>A. nerii</i> (Boyer)	Mar., Oct.
	(ii) <i>A. malvae</i> (Koch)	Oct., Nov.
<i>Cucurbita moschata</i> (kadu)	<i>A. malvae</i> (Koch)	May, June
	<i>A. malvoides</i> , n. sp.	Oct., Nov.
<i>Cucumis sativa</i>	<i>A. malvae</i> (Koch)	Feb., Apr.
<i>Cucumis melo</i> (kakri and kharbuza)	<i>A. malvoides</i> , n. sp.	May.
<i>Cynodon dactylon</i> (dub)	(i) <i>Pemphigus</i> sp.	Nov., Mar.
	(ii) <i>A. maidis</i> (Fitch)	Dec.
	(iii) <i>Siphocoryne avenae</i> (Fabr.)	Mar., Apr.
	(iv) <i>Toxoptera graminum</i> (Rond.)	Apr.
<i>Cyperus rotundus</i> (dila or motha)	(i) <i>Toxoptera cyperi</i> (van der Goot.)	Sep., Nov.
	(ii) <i>Toxoptera graminum</i> (Rond.)	Mar.
	(iii) <i>A. maidis</i> (Fitch)	Mar.
<i>Cyperus niveus</i>	<i>Toxoptera graminum</i> (Rond.)	Nov.
<i>Cyamopsis psoraliodes</i> (guara)	<i>A. medicaginis</i> , Koch	Nov., Dec.
<i>Dalbergia sisso</i>	(i) <i>A. medicaginis</i> , Koch	Feb., Mar.
	(ii) <i>Myzus persicae</i> (Sulz.)	Apr.
<i>Dianthus caryophyllus</i> (pink)	(i) <i>Myzus persicae</i> (Sulz.)	Feb., Mar.
	(ii) <i>A. malvae</i> (Koch)	Mar.
<i>Datura stramonium</i>	(i) <i>Myzus persicae</i> (Sulz.)	Jan., Feb.
	(ii) <i>Siphocoryne avenae</i> (migrants only).	Sep.
<i>Daucus carota</i>	<i>Brevicoryne coriandri</i> , n. sp.	April (scarce).
Dila (see <i>Cyperus</i> or <i>Scirpus</i> sp.).		
<i>Dolichos lablab</i> (viru sem; pink and white).	<i>A. medicaginis</i> , Koch	Oct., Dec.
<i>Dregea</i> sp. (Asclepiadaceae)	<i>A. nerii</i> (Boyer)	May.
<i>Durranta</i> sp. (hedge plant)	(i) <i>A. malvoides</i> , n. sp.	Sep., Dec.
	(ii) <i>A. durranti</i> , n. sp.	
Dhanian (see <i>Coriander</i>).		
<i>Erruca sativa</i>	(i) <i>Myzus persicae</i> (Sulz.)	Oct.
	(ii) <i>Siphocoryne indobrassicae</i> , n. sp.	Oct., Dec.
Elm (Indian) (see <i>Celtis australis</i>).		
<i>Euphorbia helioscopia</i> (sun spurge)	<i>Myzus persicae</i> (Sulz.)	Jan., Feb.
<i>Eriobotrya japonica</i>	<i>A. malvae</i> (Koch)	Oct.
<i>Eragrostis</i> sp.	(i) <i>Macrosiphum granarium</i> (Kirby)	Apr.
	(ii) <i>Siphocoryne avenae</i> (Fabr.)	
<i>Faeniculum vulgare</i>	<i>Siphocoryne coriandri</i> , n. sp.	Apr. (scarce).
<i>Gallium</i> sp.	<i>Myzus persicae</i> (Sulz.)	Apr.
<i>Gossypium harbaccus</i> (cotton)	(i) <i>A. malvae</i> (Koch)	Apr., Nov.
	(ii) <i>A. gossypii</i> (Glov.) ?	Apr., Nov.
	(iii) <i>A. malvoides</i> , n. sp.	
Gulab (see <i>Rosa</i>).		
Guldaudi or Guldhudi (see <i>Chrysanthemum</i>).		
Guara (see <i>Cyamopsis</i> sp.).		

PLANTS.	APHIDS.	DATE.
Gobhi (see <i>Brassica</i> sp.).		
Halon (see <i>Lepidium</i>).		
<i>Hibiscus esculentis</i> (bhindi)	<i>A. malvae</i> (Koch)	Aug., Nov.
<i>Hibiscus canabis</i>	<i>A. malvoides</i> , n. sp.	March.
<i>Hibiscus magnifica</i>	<i>A. malvae</i> (Koch)	Dec.
	<i>A. malvae</i> (Koch).	
	<i>A. malvoides</i> , n. sp.	Dec.
<i>Hoya volubillis</i>	<i>A. nerii</i> (Boyer)	Sep., Nov., May.
<i>Hordeum vulgaris</i> (jan.)	(i) <i>Macrosiphum granarium</i> (Kirby)	} Nov. to March.
	(ii) <i>Toxoptera graminum</i> (Rond.)	
	(iii) <i>A. maidis</i> (Fitch)	
	(iv) <i>Siphocoryne avenae</i> (Fabr.)	
Harmal (see <i>Peganum</i>).		
Holly (see <i>Malva</i> sp.).		
<i>Iberis</i> sp.	<i>Brevicoryne</i> (= <i>Aphis</i>) <i>brassicae</i> (Linn.)	Feb.
Indian Corn (see <i>Zea mays</i>).		
<i>Ipomea mexicana</i>	} (i) <i>A. malvae</i> (Koch)	} Sep., Oct. and Nov.
<i>I. palmata</i>		
<i>I. guttata</i>	(ii) <i>A. malvoides</i> , n. sp.	} Nov. and Dec. (in Bihār).
<i>Indigofera tinctoria</i>	<i>A. medicaginis</i> , Koch	
<i>Jasminum</i> sp. (hasna)	<i>A. malvae</i> (Koch), dark green variety	Dec.
Jaintar (see <i>Sesbania</i>).		
Jau (see <i>Hordeum</i>).		
Jawi (see <i>Avena</i>).		
Juar (see <i>Sorghum</i>).		
Kachalu (see <i>Colocasia esculentis</i>).		
Kakkar Singi (see <i>Pistacia</i>).		
Khub Kalan (see <i>Sisymbrium</i>).		
Kanwal (see <i>Nelumbium</i>).		
Kali tori (see <i>Luffa</i>).		
<i>Lagenaria vulgaris</i> (ghia)	<i>A. malvae</i> (Koch)	Apr., Jun.
	<i>A. gossypii</i> (Glov.)	
	<i>A. malvoides</i> , n. sp.	
<i>Lathyrus sativa</i> (charal)	<i>A. medicaginis</i> , Koch	Jan.
<i>Lathyrus odoratum</i> (sweet peas)	(i) <i>Macrosiphum pisi</i> (Kirby)	Feb., Mar.
	(ii) <i>Macrosiphum</i> sp.	April.
<i>Lemna</i> sp.	<i>Siphocoryne nymphaeae</i> (Linn.)	Nov., Dec., Apr., July.
<i>Leucas</i> sp. (labiate weed)	<i>A. malvae</i> (Koch)	Nov. (at Pusa).
<i>Letsonia scandens</i>	<i>Brachionguis letsoniae</i> , n. sp.	Oct.
<i>Lepidium sativa</i>	(i) <i>Myzus persicae</i> (Sulz.)	Feb., Mar.
	(ii) <i>Siphocor. indobrassicae</i> , n. sp.	
Loqat (see <i>Eriobotrya</i> sp.).		
Lobia (see <i>Dolichos</i>).		
<i>Luffa octangula</i>	<i>A. malvae</i> (Koch)	Aug., Sep.
	<i>A. malvoides</i> , n. sp.	
Lucerne (see <i>Medicago sativa</i>).		

PLANTS.	APHIDS.	DATE.
<i>Malva sylvestris</i>	{ <i>A. malvoides</i> , n. sp.	Nov., Feb.
<i>M. parviflora</i>		Oct., Nov.
		Apr.
<i>Malvestrum tricuspidatum</i>	(i) <i>A. malvae</i> (Koch)	Oct., Dec.
	(ii) <i>A. malvoides</i> , n. sp.	Mar., Apr.
<i>Mazus</i> sp.	<i>Myzus persicae</i> (Sulz.)	May.
<i>Medicago sativa</i> (lucerne)	(i) <i>Callipterus trifolii</i> (Monell)	Apr., May.
	(ii) <i>Macrosiphum pisi</i> (Kalt.)	
<i>Medicago dentatus</i>	<i>A. medicaginis</i> , Koch	Jan., Feb.
<i>Melilotus parviflora</i> (senji)	<i>A. medicaginis</i> , Koch	Feb., Apr.
Melon (see <i>Cucumis</i>).		
Muli (see <i>Raphanus</i>).		
Mustard (see <i>Brassica</i>).		
Milkweed (see <i>Calotropis</i>).		
<i>Nicotiana tabacum</i>	(i) <i>Siphocoryne avenae</i> (Fabr.)	Nov., Dec. (at Pusa).
	(ii) <i>Myzus persicae</i> (Sulz.), pink variety.	Mar., Apr.
<i>Nelumbium speciosum</i> (kanwal)	<i>Siphocoryne nymphaeae</i> (Linn.)	Nov.-Dec.
<i>Nepeta</i> sp.	<i>A. malvae</i> (Koch) (green variety)	Aug.
<i>Nasturtium</i> sp.	(i) <i>Aphis nasturtii</i> (Kalt.)	
	(ii) <i>Myzus persicae</i> (Sulz.)	
	(iii) <i>Siphocoryne indobrassicae</i> , n. sp.	Feb., Apr.
Oats (see <i>Avena</i>).		
Orange (see <i>Citrus</i>).		
Palak (see <i>Beta</i> sp.).		
Pansy (see <i>Viola</i>).		
<i>Panicum colonum</i>	(i) <i>A. maidis</i> (Fitch)	June, Sep., Dec.
	(ii) <i>A. sacchari</i> (Zehnt.)	June, Sep., Dec.
<i>Panicum</i> sp.	<i>A. maidis</i> (Fitch)	March.
<i>Peganum harmala</i>	(i) <i>Brachiunguis harmalae</i> , n. sp.	Sep., Dec., Mar., May.
	(ii) <i>A. malvae</i> (Koch)	Nov.
	(iii) <i>Macrosiphum pisi</i> (Kalt.)	Feb.
<i>Pennisetum typhoideum</i> (bajra)	<i>A. maidis</i> (Fitch)	Sep., Oct.
<i>Phaseolus radiatus</i>	{ <i>A. medicaginis</i> , Koch	July, Sep., Oct.
<i>Phaseolus</i> sp.		
<i>Phragmites karki</i> (reed)	<i>Hyalopectus pruni</i> (Fabr.)	Sep., Dec., Mar.
<i>Pistacia integerrima</i>	<i>Pemphigus</i> (?) <i>aedificator</i> (Buck.)	Apr., Nov.
<i>Prunus domesticus</i> (plums, alucha)	<i>Tuberodryobius persicae</i> (Cholodk.)	Sep., Dec., Feb., Mar., May.
	<i>Toxoptera punjabipyri</i> , n. sp.	Dec.
<i>Prunus malus</i> (apple)	<i>A. malvoides</i> , n. sp.	Oct., Nov.
<i>Prunus persicae</i> (peach, aru)	(i) <i>Brachycaudus pruni</i> (Koch) (= <i>Aphis pruni</i>).	Mar., May.
	(ii) <i>Myzus persicae</i> (Sulz.)	Mar., May.
	(iii) <i>Tuberodryobius persicae</i> (Cholodk.)	Sep., Jan.
	(iv) <i>Hyalopectus pruni</i> (Fabr.)	Mar., Apr., Oct., Nov and Dec.

PLANTS.	APHIDS.	DATE.
<i>Pyrus communis</i> (pear)	(i) <i>A. malvae</i> (Koch)	} Feb., Mar. and Apr.
	(ii) <i>Myzus persicae</i> (Sulz.)	
	(iii) <i>Toxoptera punjabipyri</i> , n. sp.	
<i>Pyrus</i> sp. (wild)	<i>T. punjabipyri</i> , n. sp.	Mar., Apr.
Potato (see <i>Solanum tuberosum</i>).		
Pilak (see <i>Solanum nigrum</i>).		
<i>Raphanus sativa</i> (radish)	(i) <i>Myzus persicae</i> (Sulz.)	Oct., Apr.
	(ii) <i>Brevicoryne brassicae</i> (Linn.)	Mar., Apr.
	(iii) <i>Siphocoryne indobrassicae</i> , n. sp.	Oct., Mar.
Rape (see <i>Brassica</i> sp.).		
<i>Rosa damascous</i>	{ (i) <i>Macrosiphum rosaeiformis</i> , n. sp.	December to Apr.
<i>Rosa</i> spp.		Dec.-Mar.
<i>Salix babilonica</i>	<i>Tuberolachnus viminalis</i> (Boyer)	Feb.-May.
<i>Salix tetrasperma</i>	(i) <i>Tuberolachnus viminalis</i> (Boyer)	March.
	(ii) <i>Eichochaitophorus himalayensis</i> , n. sp.	Mar., June.
<i>Salix aegyptica</i> Das (bed mushk)	<i>Tuberolachnus viminalis</i> (Boyer)	March.
<i>Salvia</i> sp. (wild)	<i>A. malvae</i> (Koch) (green variety)	Mar., Apr.
<i>Sisymbrium irio</i> (khub kalan)	<i>Siphocoryne indobrassicae</i> , n. sp.	Dec., Mar.
<i>Setaria verticillata</i>	<i>A. maidis</i> (Fitch)	Nov.
<i>Scirpus lacustrus</i>	(i) <i>Siphocoryne nymphaeae</i> (Linn.)	Jan.
	(ii) <i>Toxoptera</i> sp.	
<i>Sesbania aegyptica</i> (jaintar)	<i>A. medicaginis</i> , Koch	Feb., Mar.
Shalgum (see <i>Brassica</i>).	<i>A. malvoides</i> , n. sp.	April.
<i>Solanum indicum</i> (kandari)		
<i>Solanum lycopersicum</i>	<i>A. malvoides</i> , n. sp.	Mar.
<i>Solanum melongium</i>	(i) <i>A. malvoides</i> , n. sp.	Mar., Apr.
	(ii) <i>A. gossypii</i> (Glover) ?	Oct., Nov.
<i>Solanum nigrum</i>	(i) <i>A. rumicis</i> , Linn.	Sep., Dec.
	(ii) <i>A. malvae</i> (rarely)	Feb., Apr. and Aug.
<i>Sonchus oleracea</i>	{ (i) <i>Macrosiphum solidaginis</i> , Fabr.	Jan.-May
<i>S. arvensis</i>		May, June.
<i>Sorghum vulgare</i>	(i) <i>Aphis sacchari</i> (Zehnt.)	June-Sep., Dec.
	(ii) <i>A. maidis</i> (Fitch)	
Tori, tomato, tobacco (see <i>Luffa</i> ; <i>Solanum</i> ; <i>Nicotiana</i>).		
<i>Tribulus terrestris</i>	<i>Aphis medicaginis</i> , Koch	May-June.
<i>Triticum sativum</i>	(i) <i>Macrosiphum granarium</i> (Kirby)	Nov., Apr.
	(ii) <i>Toxoptera graminum</i> (Rond.)	Feb., Apr.
	(iii) <i>Siphocoryne avenae</i> (Fabr.)	Oct., Dec.
<i>Trigonella foenum-graecum</i> (methi)	(i) <i>A. medicaginis</i> , Koch	Mar., Apr.
	(ii) <i>Macros. pisi</i> (Kalt.)	
<i>Vicia faba</i> (bakla)	<i>A. medicaginis</i> , Koch	Oct., Dec.
<i>Viola tricolor</i>	(i) <i>A. malvae</i> (Koch)	Apr.
	(ii) <i>Myzus persicae</i> (Sulz.)	Mar.
	(iii) <i>A. malvoides</i> , n. sp.	Apr.
<i>Vitex negundo</i>	<i>A. durranti</i> , n. sp.	Dec.
	<i>A. malvoides</i> , n. sp.	

PLANTS.	APHIDS.	DATE.
Willows (see <i>Salix</i> spp.).		
<i>Withania somniferum</i>	<i>A. malvae</i> (Koch)	Mar.
<i>Woodfordia floribunda</i> (dhawa)	<i>A. malvae</i> (Koch)	Oct. and Apr.
<i>Zea mays</i>	<i>Aphis maidis</i> (Fitch)	Aug., Sep.

The more important literature is cited at the beginning of each description ; a complete separate bibliography is not given for considerations of space.