*International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)*
*An Online International Journal Available at http://www.cibtech.org/jfav.htm*
*2012 Vol. 2 (3) September-December, pp. 116-125/Bhagat*

***Research Article***

# APHIDS (INSECTA) OF AGRICULTURAL IMPORTANCE IN J&K STATE, INDIA: A CHECKLIST AND BIODIVERSITY

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## ABSTRACT
The present papers deals with 31 aphid species, distributed over 20 genera, belonging to four subfamilies,v*iz.* Aphidinae, Calaphidinae, Chaitophorinae and Eriosomatinae of family Aphididae, damaging 31 species of agricultural crops (cereals, vegetables and fruits), of 12 different plant families, occurring in diverse areas and localities of Jammu, Kashmir and Ladakh regions of J&K State. The database pertaining to aphid-fauna of agricultural importance has been updated in the light of recent systematic and nomenclatural changes. An updated checklist of aphid species has been provided. In addition to this, biodiversity of various aphids of economic importance, covering species richness host-crops diversity and, nature and extent of damage rendered by serious aphid pests, have also been briefly discussed.

***Key Words:*** *Aphids, Crops, Checklist, Biodiversity, J&K State*

## INTRODUCTION
Aphids are small soft-bodied insects, commonly known as plant- lice or greenflies, belonging to order Hemiptera, suborder Stenorrhyncha, superfamily Aphidoidea and family Aphididae. The different aphid species damaging agriculture crops (cereals, vegetables and fruits) in Jammu, Kashmir and Ladakh regions of J&K State, are not only abundant form of insects, but also show rich biodiversity, existing in the form of apterous adults and winged form, in diverse localities and areas of this region of paramount Zoogeographical importance in north-west Himalaya. More than 31 species of aphids have been found to feed on wide range of host- crop species, with varying degree of host specificity. Most species are more or less monophagous and many species as polyphagous, having complex life-cycle, with alteration of parthenogenetic and sexual generations.

The previous main research papers, published from time to time, regarding aphid pests attacking agricultural crops, pertaining to J&K State, have been given by Fotedar and Kapur, (1943); Rishi, (1968,69); David *et al.*, (1971); Bhagat, (1986, 86a); Mosoodi *et al*., (1987); Bhagat and Masoodi, (1988); Bhat and Bali, (1989); Bhagat *et al*., (1990); Bhagat and Ahmad, (1991); Bhat, (1991); Pandit, (1992); Zaki, (1999); Zaz, (2001); Nehru *et al.*, 2005; Pandey *et al*., (2006); Kant, (2007); Bhat, (2008) and Arora *et at.*, (2009).

In the present paper, updated information is provided on the systematic position, nomenclatural changes, host-crop diversity and richness of about 31 aphid species, damaging 31 species of valuable agricultural crops (cereals, vegetables and fruits), belonging12 host-plant/ cropfamilies, occurring in wide localities/ areas of J&K State. For the purpose of updating of database pertaining to aphid- fauna, infesting agricultural crops of this region of Indian sub-continent, Eastop and Hille Ris Lambers, (1976), Remaudiere and Remaudiere, (1997) and Holman (2009) have been followed.

## RESULTS AND DISCUSSION
Five economically important cereal/food crops, v*iz.*, *Fagopyrum esculentum, Hordeum vulgare, Trapa natan, Triticum aestivum* and *Zea mays*, belonging to plant families- Poaceae, Polygonaceae and Trapaceae, have been found to be infested with 9 aphid species, under 8 genera of subfamily Aphidinae and Chaitophorinae (see Table 1 and 2).

The vegetable crops of 12 plant species as *Brassica juncea, Brassica napus, Brassica oleracea, Cucumis sativus, Cucurbita maxima, Daucus carota, Lycopersicon esculentum, Phaseolus coccineus, Phaseolus vulgaris, Pisum sativum, Rumex acetosa, Solanum tuberosum* belonging to 6 plant families *viz.* Apiaceae, Brassicaceae, Cucurbitaceae, Fabaceae, Polygonaceae and Solanaceae showed high infestations of aphid species. As many as 8 species of aphids, fewer than 6 genera, pertaining to sub-family Aphidinae have shown infestations in these valuable vegetable crops, in diverse localities of the region (see Table 1 and 2).

The various aphid pests, damaging economically important fruit crops (stone and pome) of this region included C*itrus sinensis, Malus domestica, Prunus armeniaca, Prunusavium, Prunus domestica* var. *insititia, Prunus persica* var. *flordsun, Punica granatum, Pyrus malus, Prunus dulcis, Rubus antennifer, Rubus fruticosus* and *Juglans regia,* belonging to host crop/ plant families as Juglandaceae, Punicaceae, Rosaceaae and Rutaceae. A total of 20 aphid species, under 14 genera, belonging to subfamilies, *viz.* Aphidinae, Calaphidinae and Eriosomatinae is known to attack aforementioned 12 fruit crops, in vast areas and localities of J&K State (see Table 1 and 2).

The various aphid genera (20), with total number of species, for each genusof agricultural importance are: *Acyrthosiphon* (2spp.), *Aphis* (6); *Brachycaudus* (2); *Brevicoryne* (1); *Cavariella* (1); *Chaetosiphon* (1); *Chromaphis* (1); *Eriosoma* (1); *Hyalopterus* (2); *Lipaphis* (2); *Macrosiphum* (1); *Megoura* (1); *Myzus*(1); *Panaphis* (1); *Rhopalosiphum* (3); *Schizaphis*(1); *Semiaphis* (1); *Sipha* (1); *Sitotion* (1) and *Toxoptera* (1) (see Table 1).

The 31 aphid species, belonging to 21 genera, showing wide occurrence in cultivated avenues of this region, with nature and extent of damage rendered by some of the potential pests of the economically important crops, are briefly highlighted as under:

***Acyrthosiphon* spp.**

The genus *Acyrthosiphon* ofagricultural importance is represented by two species: *A. pisum* (Pea-aphid) and *A. rubi,* damaging garden pea and wildblackberry respectively. The main aphid pest of agricultural importance, *A. pisum* is responsible for causing losses to the host crop by feeding on phloem sap, besides being vector of many diseases.

***Aphis* spp.**

This aphid genus being a dominant genus of great economic importance, including six species *viz.*, *A. citricola* (Green citrus aphid), *A. craccivora* (Ground nut/ cowpea aphid), *A. gossypii* (Cotton or melon aphid), *A. pomi* (Green apple aphid). *A. punicae* (Pomegernate aphid) and *Aphis* sp., attacking all the three major agricultural crops i.e. cereal, vegetable and fruit. The host- crops damaged by the above mentioned aphid species are: cereals-buckwheat, common wheat; vegetables- cucumber, pumpkin, beans, gardenpea and sorrel, potato; fruits- sweet orange, apple, pear, plum, pomegranateand raspberry.Of the various species ofgenus *Aphis, A. craccivora* and *A. gossypii,* are polyphagous aphids pests, causing heavy damages to vegetable crops and are, known to attack as many as 6 and 5 different host crop species respectively.

***Brachycaudus* spp.**

The two species of this genus as *B. helicherysi* (Leaf- curling plum aphid) and *B. persicae* (Black peach aphid), the former aphid pest causing severe damage to Plum tree leaves and shedding of flowers and young fruit, and latter pest is responsible for main damage to the growth of young fruit trees of peach as well as almondin different localities of Kashmir valley.

***Brevicoryne brassicae***

High percentage of *B. brassicae* (Cabbage aphid) is known to cause severe damage to cultivated vegetables (cole crops), *Brassica oleracea* and its varieties, v*iz*. cauliflower, cabbage, knolkhol and kale, etc. This aphid pest causing damage to both sides of leaves of the host crop, leading to stunted growth, distortion, wilting and yellowing.

***Cavariella aquatica***
*C. aquatica* has been reported to damage barley in cold arid zones of Ladakh. Normally this aphid is attacking *Salix*in many parts of Ladakh and Kashmir valley.

***Chaeosiphon glaber***
*C. glaborum* has been noticed to damage *Rubus fruiticosus* (wild blackberry) in vastareas and localities of Kashmir.

***Chromaphis juglandicola***
The leaves of walnut trees have been found to be attacked by dense colonies of *C. juglandicola* (walnut aphid) in many areas and localities of Kashmir region.

***Eriosoma lanigerum***
*E. lanigerum* is a main aphid pest of apple tree in Kashmir, commonly known as woolly apple aphid, showing cotton, like white wax. It is having wide occurrence in this region, attacking solely the twigs of the host plant and heavy infestations causing gall- formation and cracking of bark of apple trees.

***Hyalopterus* spp.**
*H. amygdali* (Mealy peach aphid) and *H. pruni* (Mealy plum aphid), are not only serious aphid pests of plum and peach fruit crops, but also apple, apricot, sweet cherry and pear. The dense colonies of aphids covered with white mealy wax, severaly affecting the leaves of these fruit trees.

***Lipaphis* spp.**
This genus is represented by two species, viz. *L. erysimi* (Turnip aphid) and *L. pseudobrassicae* (Mustard aphid), damaging *Brassica napus* and *Brassica juncea* (cruciferous crop), respectively. *Lipaphis s*pp., alsoshowing the presence of dense coat of white wax

***Macrosiphum (Sitobion) miscanthi***
*M.(Sitobion) miscanthi* (Grain or wheat aphid) is found to render damage tocereal crop ,Common wheat.

***Megeura pallipes***
*M. pallipes* has been found to be damaging the leaves of pear tree in Kashmir region.

***Myzus persicae***
This aphid pest is commonly known as Green peach or potato aphid and has been found to be as a polyphagous aphid pest of this region, greatly affectingthe fruit trees like apple, apricot peach and common pear, besides vegetable crops like tomato and potato. The dense colonies of *M .persicae* causing flowers and leaves of the host-crops to curl tightly, the fruitlet may not develop or may drop.

***Panaphis juglandis***
It is pest of walnut trees in this region, previously reported under the name *Callaphis juglandis,* as a synonym of *P.juglandis*. The dense populations of this aphid has been reported to cause damage the leaves of the walnut tree in vast areas and localities of Kashmir valley.

***Rhopalosiphum* spp.**
Three species of *Rhopalosiphum,* are known to be as important pestsof agricultural crops (cereals and fruits) in this region as *R. insertum* (apple grain or apple grass aphid), *R. maidis* (leaf- corn aphid) and *R. nymphaeae* (Waterlily or plum aphid).*R. nymphaeae* has beenobserved to damage the leaves of fruit trees like apricot and plum, in addition to cereal crop, water chestnut. *R. insertum,* is not a serious pest of apricot and plum tree, however, causing curling perpendicular to the midrib on young leaves. *R.maidis* is found to be causing damage by feeding on the young leaves of valuable cereal crops- wheat and maize.

***Schizaphis graminum***
*S. graminum* is also known as Green bug or Spring grain aphid, feeding on the leaves of host crops, *viz.* common wheat, leading to yellowing and other phytotoxic effects in wheat crop.

***Semiaphis heraclei***
*S. heraclei* has been found in this region in high population densities, damaging wild carrot( *Daucus carota*).

***Sipha maydis***
*S. maydis* has been reported to be aphid pest of cereal crop, barley.

***Sitobion avenae***
This aphid is also known as Grain aphid, causing, serious direct damage to wheat and barley by feedingon the developing ears by dense colonies of this species.
***Toxoptera aurantii***
In this region, *T. aurantii* commonly known as Black citrus aphid, has been reported as a major pest of sweet orange. The dense colonies of this aphid attack young shoot and undersides of leaves of orange trees, causing slight rolling, twisting or bending of midrib.

**Table 1: Aphidsdamaging agricultural crops (cereal/food, vegetable and fruit) in Jammu, Kashmir and Ladakh region of J&K State.**

| **Systematic position/ Aphid species (a)** | **Crop species (b)** | **Type of crop (c)** |
|---|---|---|
| **Subfamily1. Aphidinae.** | | |
| **Tribe1. Aphidini** | | |
| **Subtribe1. Aphidina** | | |
| *Aphis citricola* vander Goot (= *Aphis spiaecola* Patch) | *Rubus antennifer* Hook f. | FC |
| *Aphis (A.) craccivora* Koch | *Cucumis sativus* (Linn.) | VC |
| *Aphis (A.) craccivora* Koch | *Phaseolus coccineus* (Linn.) | VC |
| *Aphis (A.) craccivora* Koch | *Phaseolus vulgaris* (Linn.) | VC |
| *Aphis (A.) craccivora* Koch | *Rumex acetosa* (Linn.) | VC |
| *Aphis (A.) craccivora* Koch | *Sotanum tuberosum* (Linn.) | VC |
| *Aphis (A.) craccivora* Koch | *Triticum aestivum* (=v*ulgare*) (Linn.) | VC |
| *Aphis (A.) gossypii* Glover | *Citrus sinensis* (Linn.) | FC |
| *Aphis (A.) gossypii* Glover | *Cucurbita maxima* Duchensc | VC |
| *Aphis (A.) gossypii* Glover | *Fagopyrum esculentum* Moench | CC |
| *Aphis (A.) gossypii* Glover | *Malus domestica* Borkh. (=*Malus pumila* Kitam) | FC |
| *Aphis (A.) gossypii* Glover | *Pyrus communis* Linn. | FC |
| *Aphis (A.)* pomi De Greer | *Malus domestica* Borkh | FC |
| *Aphis (A.)* pomi De Greer | *Punica granatum* Linn. | FC |
| *Aphis (A.) punicae* Passerini | *Punica granatum* Linn. | FC |
| *Aphis sp.* | *Malus domestica* Barkh | FC |
| *Aphis sp.* | *Prunus domestica* Linn. | FC |
| *Toxopteraaurantii* -(Boyer de Fonschombe) | *Citrus sinensis* (Linn.) | FC |
| **Subtribe 2. Rhopalosiphina** | | |
| *Hyalopterusamygdale*-(Blanchard) | *Prunus armeniaca* Linn. | FC |
| *Hyalopteruspruni* (Geoffroy) -(Blanchard) (=*Hyalopterusarundinis* Fab.) | *Malus domestica* Borkh. | FC |

| | | |
|---|---|---|
| *Hyalopteruspruni* (Geoffroy*)* | *Prunus avium* Linn. | FC |
| *Hyalopteruspruni* (Geoffroy***)*** | *Prunus domestica* var. *insititia* (Linn.) | FC |
| *Hyalopteruspruni* (Geoffroy*)* | *Pyrus communis* Linn. | FC |
| *Rhopalosiphuminsertum*-(Walker) | *Prunus armeniaca* Linn. | FC |
| *Rhopalosiphuminsertum*-(Walker) | *Prunus domestica* Linn. | FC |
| *Rhopalosiphuminsertum*-(Walker) | *Prunus domestica* var. *insititia* (Linn.) | FC |
| *Rhopalosiphummaidis* (Fitch) | *Triticum aestivum* Linn. | CC |
| *Rhopalosiphummaidis* (Fitch) | *Zea mays* | CC |
| *Rhopalosiphumnymphaeae*-(Linn.) | *Prunus armeniaca* Linn. | FC |
| *Rhopalosiphumnymphaeae*-(Linn.) | *Prunus domestica* L.var. *insititia* L. | FC |
| *Rhopalosiphumnymphaeae*-(Linn.) | *Trapanatans*Linn. | CC |
| *Schizaphis (Schizaphis)-graminum* (Rondani*)* | *Triticum aestivum* Linn. | CC |
| **Tribe 2.Macrosiphini** | | |
| *Acyrthosiphon (Ac.) pisum*-(Harris) | *Pisum sativum* Linn. | VC |
| *Acyrthosophon (Ac.)rubi*-Narzikulov | *Rubus fruticosus* Lucviatour. JPG | FC |
| *Brachycandus* (*Br.) helicherysi*-(Kaltenbach) | *Prunus persica* (Linn.) | FC |
| *Brachycandus* (*Br.*) *helicherysi*-(Kaltenbach) | *Prunus persica* var.*flordasun* | FC |
| *Brachycaudus (Acaudus)persicae*-(Passerini) (=*Anuraphispersicaeniger*-Smith) | *Prunusdulcis* (Miller) (=*Prunus amygdalus* Batsch) | FC |
| *Brchycaudus (Acaudus) persicae* -(Passerini) | *Prunus persica* ( Linn.) | FC |
| *Brevicoryne brassicae* (L) | *Brassica oleracea*(Linn.) | VC |
| *Brevicoryne brassicae* (L) | *Brassica o.*var. *acephala* | VC |
| *Brevicoryne brassicae* (L) | *Brassica o.*var.*botrytis* | VC |
| *Breviorynebrassicae* (L) | *Brassica o.*var. *capitata* | VC |
| *Brevicoryne brassicae* (L) | *Brassica o var..gonylodes* | VC |
| *Brevicoryne brassicae* (L) | *Brassica o.*var.*kashmiriana* | VC |
| *Cavariella(Cavariella)aquatica* -(Gillette & Bragg*).* | *Hordeumvulgare*Linn. | CC |
| *Chaetosiphon (Pentatrichopus) -glabrum* David, Rajsingh &-Narayan | *Rubus fruticosus* Sm. | FC |
| *Lipaphis (Lip.) erysimi*-(Kaltenbach) | *Brassica napus* (Linn.) (= *Brassica campestris* L.) | VC |
| *Lipaphis pseudobrassicae*-(Davis) | *Brassica juncea* Linn. | VC |
| *Magourapallipes* Basu | *Pyrus communis* Linn. | FC |

| | | |
|---|---|---|
| *Macrosiphum (Sitobion) miscanthi* -(Takahashi) | *Triticum aestivum*Linn. | CC |
| *Myzus (Nectarosiphon)-persicae* (Sulzer) | *Lycopersiconesculentum* Mill | VC |
| *Myzus (Nectarosiphon)-persicae* (Sulzer) | *Malus domestica*Borkh. | FC |
| *Myzus (Nectarosiphon)-persicae* (Su lzer) | *Prunus armeniaca*Linn. | FC |
| *Myzus (Nectarosiphon-)persicae* (Sulzer) | *Prunuspersica*Linn. | FC |
| *Myzus (Nectarosiphon)-persicae* (Sulzer) | *Pyruscommunis* Linn. | FC |
| *Myzus (Nectarosiphon)-persicae* (Sulzer) | *Solanum tuberosum* Linn. | VC |
| *Semiaphisheraclei*-(Takahashi) | *Daucus carota*Linn. | VC |
| *Sitobion (Sito.) avenae*-(Fabricius) | *Triticumaestiv*um Linn | CC |
| *Sitobion (Sito.) avenae* (Fabricius) | *Hordeumvulgare*(Linn.) | CC |
| **Subfamily 2.Calaphidinae** | | |
| **Tribe 1.Calaphidini** | | |
| *Betacalis*sp. | *Juglans regia* (Linn.) | FC |
| **Tribe 2.Panaphidini** | | |
| *Panaphisjuglandis* (Goere) (= *Callaphisjuglandis*) | *Juglans regia* (Linn.) | FC |
| **Subtribe 1 Panaphidina** | | |
| *Chromaphisjuglandicola*- (Kaltenbach) | *Juglans regia*(Linn.) | FC |
| **Subfamily 3. Chaitophorinae** | | |
| **Tribe 1.Siphini** | | |
| *Sipha (Rungsia) maydis*- Passerini | *Hordeum vulgare(*Linn.) | CC |
| **Subfamily 4. Eriosomatinae** | | |
| **Tribe 1. Eriosomatini** | | |
| *Eriosomala nigerum*-(Hausmann ) (=*Maluspumila*Kitam) (= *Pyrusmalus*) | *Malus domestica* Borkh | FC |

***Abbrv.*** *(CC= Cereal crop; FC= Fruit crop; VC= Vegetable crop; synonyms of aphid and crop species given in parentheses)*

**Table: 2. Host-Crop (cereal, vegetable, fruit)–Aphid List**
**(Numbers in parentheses indicate family of crop)**
**Host – Crop Species/Common name (Family)/Aphid Species.**

**I. Cereal Crops**

*i) Fagopyrum esculentum* (Buckwheat) (7).
*Aphis gossypii*
*ii) Hordeum vulgare* (Barley) (6)
*Cavariellaaquatica, Siphamaydis, Sitobionavenae*
*iii) Trapanatans* (WaterChestnut) (12)
*Rhopalosiphum nymphaeae*
*iv)Triticum aestivum* (Common wheat) (6)
*Aphiscraccivora, Rhopalosiphmaidis, Macrosiphum (Sitobion) miscanthi, Schizaphis graminum, Sitobionavenae*
*v)Zea mays* (Maize , Indian Corn) (6)
*Rhopalosiphummaidis*

**II.Vegetable Crops**

*i) Brassica juncea (*Indian Mustard*)*(2)
*Lipaphispseudobrassicae*
*ii) Brassicanapus*(oil /rape seed oil) (2)
*Lipaphiserysimi*
*iii) Brassica oleracea* (Cultivated vegetable) (2)
Varieties*: Brassica.o.* var. *acephala* (Khanyari Haak). *B.o.*var. *botyrtis* (Cauliflower); *B.o.*var.*capitata* (Cabbage); *B.O.* var.*gongylodes* (MongHaak); *B.o.*var. *kashmiriana,* (HanzHaak)
*iv) Cucumissativus*(Cucumber) (3)
*Aphiscraccivora*
*v) Cucurbita maxima* (Red Gourd, Pumpkin) (3)
*Aphis gossypii*
*vi) Daucuscarota*(Wild Carrot) (1)
*Semiaphisheraclei.*
*vii) Lycopersicon esculentum* (Tomata) (11)
*Myzuspersicae*
*viii) Phaseolus coccineus*(Scarlet-runner Bean) (4)
*Aphis craccivora*
*ix) Phaseolus vulgaris* (Kidney Bean) (4)
*Aphiscraccivora*
*x) Pisum satvum* (Ganden Pea) (4)
*Acyrthosiphonpisum*
*xi) Rumex acetosa* (Common Garden Sorrel (7)

*Aphis craccivora*
*xii) Solanum tuberosum* (Potato) (11)
*Aphiscraccivora, Myzuspersicae*

**III.Fruit Crops**

*i) Citrus sinensis*(Sweet orange) (10)
*Aphis gossypii, Toxopteraaurantii.*
*ii)Malusdomestica* (Apple) (9)
*Aphisgossypii, A.pomi, Aphis* sp., *Eriosomala nigerum, Hyalopterus pruni, Myzu spersicae*
*iii) Prunus armeniace* (Apricot) (9)
*Hyalopterus amygdali, Rhopalosiphum insertum,*
*R. nymphaeae, Myzuspersicae*
*iv) Prunu savium* (Sweet Cherry) (9)
*Hyalopteruspruni.*
*v) Prunus domestica* (Plum) (9)
*Aphis* sp., *Hyalopterus pruni, Rhopalosiphum insertum*
*vi) Prunns domestica* var.*insititia* (Damsen Plum) (9)
*Hyalopteruspruni, Rhopalosiphum insertum,*
*R.nymphaeae.*
*vii) Prunusdulcis* (Almond) (9)
*Brachycaudus persicae*
*viii) Prunus persica*(Peach) (9)
*Brachycaudus helicherysi, B. persicae*
*Myzuspersicae*
*ix) Prunuspersica* var. *flordasun* (Peach) (9)
*Brachycaudus helicherysi*
*x)Prunusgranatum* (Pomegranate) (8)
*Aphispomi, A. punicae*
*xi) Pyruscommunis* (Common Pear) (9)
*Aphis gossypii, Hyalopteruspruni, Megoura. pallipes, Myzuspersicae.*
*xii) Rubusantennifer* (Raspberry( (9)
*Aphis citricola*
*xiii) Rubes fruticosus* (Wild blackberry) (9)
*Acyrthosiphonrubi, Chaetosiphonglabrum*
*xiv) Juglausregia* (Walnut) (5)
*Betacalis*sp., *Chromaphis juglandicola, Panaphis jugandis.*

***Abbrv.*** 1= Apiaceae; 2=Brassicaceae; 3= Cucurbitaceae; 4= Fabaceae;
5= Juglandaceae; 6= Poaceae; 7= Polygonaceae; 8= Punicaceae;9= Rosaceae; 10= Rutaceae; 11= Solanaceae; 12= Trapaceae

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