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Host Records of *Lipolexis oregmae* Gahan (Hymenoptera: Braconidae: Aphidiinae) with Food Plants in India (A Review Article)

Md. Equbal Ahmad[1]*, Nidhi Sinha[2]

[1*,2]*Aphid Systematics and Bio-control Laboratory, University Department of Zoology, T.M. Bhagalpur University, Bhagalpur– 812 007, Bihar (India)*

[1]**Email – equbal.tmbu@yahoo.com, ORCID IDs: 0000 – 0001-6775-9028*
[2]*Email: nidhisinhaarya@gmail.com, ORCID IDs: 0000 – 0002- 6770- 282X*

***Corresponding Author: -** *Md. Equbal Ahmad*
**Email – equbal.tmbu@yahoo.com, ORCID IDs: 0000 – 0001-6775-9028*

Abstract:

The present review article deals the association of *Lipolexis oregmae* Gahan with their aphid host and their food plants for the possible use in biological control programme. Aphids are small sap sucking plant bugs and most important groups of phytophagous insect because of their polymorphism, host alternative heterocious behaviour and reproductive habits, they cause serious problems on agricultural and horticultural plants even at low densities so their management is necessary.
L.oregmae Gahan is very important aphid parasitoids and widely distributed throughout the Asia and considered as an important parasitoids for the biological control programme. It has been successfully introduced in Florida and other areas. It is recorded on 19 aphid species (*Aphis* (*Toxoptera*) *aurantii*, *Aphis* (*Toxoptera*) *citricidus*, *Aphis* (*Toxoptera*) *odinae*, *Aphis craccivora*, *Aphis fabae*, *Aphis gossypii*, *Aphis nasturtii*, *Aphis nerii*, *Aphis ruborum longisetosus*, *Aphis solanella*, *Aphis spiraecola*, *Greenidae formosana*, *Liosomaphis himalayensis*, *Myzus avenae*, *Myzus* (*Nectarosiphon*) *persicae*, *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Sitobion avenae*, *Tuberolachnus salignu*) in India on several specific host plants. Its maximum parasitization was recorded on *Aphis gossypii infesting* (23 host plants), followed by *Aphis craccivora* (19 host plants), *Aphis nasturtii* (16 host plants), *Aphis spiraecola* (13 host plants) and *Myzus persicae* (9 host plants).

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Keywords: Lipolexis oregmae, host plants, Aphids, Parasitoids.

1.Introduction

Aphids (Insecta: Homoptera: Aphididae) are small sap sucking plant bugs constitute one of the most important group of phytophagous insects because of their polymorphism, host alternating heterocious behavior and reproductive habits. Most aphids are extremely host specific feeding on one or a few plant species that are usually closely related. They attack all parts of the plant and damage the crops directly by drawing sap from

plant tissue and retarding the growth and development of plants[50]. They also excrete considerable amount of honey dew that hamper their physiological processes like photosynthesis, transpiration and respiration and also allows the growth of black sooty mould on to the leaves which in turn proves detrimental to the normal activity of plant life[54]. They are also responsible for the transmission of viral diseases. The green peach aphid (*Myzus* (*Nectarosiphon*) *persicae*) can alone transmit 110 plants viruses[49]

Globally, more than 250 species of aphids are notorious pests of both agricultural and horticultural crops[49]. Hence, the control of aphids is necessary by natural enemies like predators, pathogens and parasite. For the biological control of aphids, the biology, ecology and control efficiency of the aphid parasitoids should be completely known. In India, more than 74 species of aphid parasitoids are known so far on several aphids[23]. The first work on aphid parasitoids was done in 1811 by Nees Esenback[33]. Aphid parasitoids belong to the family Aphidiidae which consists of approximately 60 genera and sub genera and more than 400 species around the world[64]. *Lipolexis* is one of the most common genera[24]. *Lipolexis* is small genus in the subfamily of Aphidiinae and widely distributed across Europe and Asia. *Lipolexis* is represented by five species, one from Europe (*Lipolexis gracilis* Forster) and four species from Asia (*Lipolexis wuyiensis* Chen, *L. oregmae* Gahan, *L. myzakkaiae* Pramanik and Raychaudhuri and *L. pseudoscutellaris* Pramanik and Raychaudhuri. Kocic *et al*. explained that two currently recognized species (*L. gracilis, L. oregmae*) which are actually a species complex and also reveal phylogenetic relationship within the genus[30]. *Lipolexis oregmae* Gahan was first described as *Diaeretus oregmae*[25] and reassigned *D. oregmae* to *Lipolexis*[61,62] . Later Mackauer described the third species *Lipolexis scutellaris* Mackauer from the oriental region[31]. It was concluded that *L. scutellaris* was junior synonym of *L. oregmae*[32]. Six species of *Lipolexis* was described in detail with the identification key[30].

Lipolexis oregmae Gahan (=*Lipolexis scutellaris,* Mackauer) is taxonomically very distinct species. It's head is smooth , yellow, sparsely haired and wider than thorax at tegulae. Antennae brown, 12-segmented, filliform and reaching to half of abdomen. Propodium areolated with wide central areola. Pterostigma triangular and twice as long as width. Radial vein more than half as long as pterostigma. The ovipositor sheaths in *L. oregmae* are short and slightly curved downwards.(Fig. 1, 2, 3, 4).

It is widely distributed throughout Asia, where it is known to attack the brown citrus aphid and several other aphid species in India. It is reported from several states of India viz., Bihar[14], Jammu and Kashmir[66], Karnataka[23];[45], Manipur[70], Meghalaya[65,66,67,68], Sikkim[1], Tripura[68], Uttar Pradesh[59], West Bengal[16,45,68].

L. oregmae is a koinobiont a parasitoid that develops inside living, mobile hosts and which benefits from the continued life and feeding of the host[27]. It has a promising host range from the biological control viewpoint[69]. *L. oregmae is* considered as an important parasitoid for the biological control programme. *L. oregmae* has proven effective against the brown citrus aphid *Toxoptera citricida*. It has been successfully introduced to Florida from Guam in biological control programme against aphid pest[38] and The establishment of *L. oregmae* in Jamaica[28]. Hence the present review paper provides the information of host range of the *L. oregmae* with their food plants.

Host finding starts with the selection of a suitable habitat with the food plants of the host aphids playing an important role because the parasitoids seem to be attracted to them[64]. Salt stated that most parasitoids are first attracted to a certain type of environment and then to a particular host[47]. The attractiveness of the host aphids to the parasitoids is apparently due to the perception of their kairomones, which seems to be present in honeydew. Host and parasitoid population densities are also important in conditioning the searching activity of the parasitoid[64].

Different aspects of biology and ecological studies were made by several workers in India and abroad. Biology, seasonal history diapauses, emergence, effect of host plants[71,45,35.] Rate of development, longevity of adults, reproductive capacity, host instar preference, host range, abundance, oviposition period hyperparasitoids[23,44.] The reproductive behavior and sex ratio on *Aphis gossypii*[34,60.] numerical response of *L. oregmae* against *Aphis craccivora*[36] host acceptance and behavior[43] host habitat selection[42.]

As per literature available, *L. oregmae* parasitized 19 aphid species in India on several specific host plants viz., *Aphis* (*Toxoptera*) *aurantii, Aphis* (*Toxoptera*) *citricidus, Aphis* (*Toxoptera) odinae, Aphis craccivora, Aphis fabae, Aphis gossypii, Aphis nasturtii, Aphis nerii, Aphis ruborum longisetosus, Aphis solanella, Aphis spiraecola, Greenidae formosana, Liosomaphis himalayensis, Myzus avenae, Myzus* (*Nectarosiphon*) *persicae, Rhopalosiphum maidis, Rhopalosiphum nymphaeae, Sitobion avenae, Tuberolachnus salignus.* The maximum parasitization was recorded on *Aphis gossypii* infesting (23 host plants), followed *by Aphis craccivora* (19 host plants), *Aphis nasturtii* (16 host plants). *Aphis spiraecola* (13 host plants) and *Myzus* (*Nectarosiphon*) *persicae* (9 host plants).

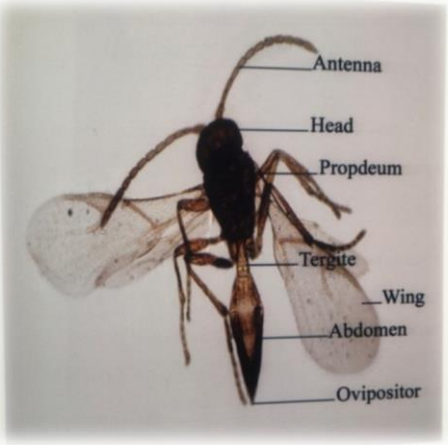

Fig- 1: *Lipolexis oregmae*

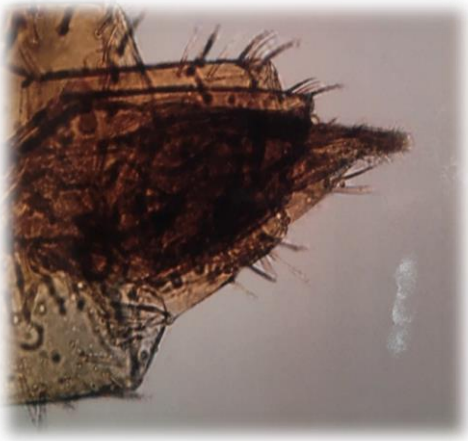

Fig- 2 : Ovipositor of *L. oregmae*

Fig – 3 : Wing of *L. oregmae*

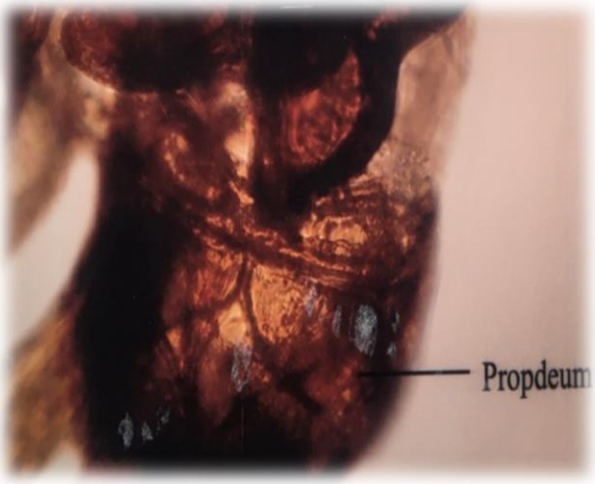

Fig - 4 : Propodium of *L. oregmae*

Table -1 Host records of *Lipolexis oregmae* Gahan with food plants

Aphids/Host plants	**Families**	**Refrences**
1. *Aphis (Toxoptera) aurantii*		
Rhus chinensis	Anacardiaceae	Subhrani *et al.* (2006)
Schima wallichii	Theaceae	Dharmadhikari and Ramaseshiah (1970)
2. *Aphis (Toxoptera) citricidus*		
Citrus sp.	Rutaceae	Stary and Ghosh (1975)
Coffea arabica	Rubiaceae	Subhrani *et al.* (2006), Pandey and Singh (2005), Stary and Ghosh (1975)

Salix sp.	Salicaceae	Stary and Ghosh (1975)
Tuberotachnus salignus	Lachninae	Stary and Ghosh (1975)
Zanthoxylum sp.	Rutaceae	Stary and Ghosh (1975)
3. *Aphis* (*Toxoptera) odinae*		
Erodium trifolium	Geraniaceae	Stary and Ghosh (1979)
Viburnum foetidum	Viburnaceae	Stary and Ghosh (1979)
4. *Aphis craccivora*		
Abelmoschus esculentus	Malvaceae	Ahmad and Singh (1997), Ahmad and Singh (2007)
Ageratum conyzoides	Asteraceae	Ahmad *et al.* (2020)
Benincasa hispida	Cucurbitaceae	Ahmad and Singh (1992-1993, 1996, 2007), Ahmad *et al.* (2020), Dharmadhikari and Ramaseshiah (1970), Stary and Ghosh (1983), Singh *et al.* (1999)
Cassia fistula	Fabaceae	Ahmad and Singh (1992-1993, 1995, 1996), Ahmad *et al.* (2020), Dharmadhikari and Ramaseshiah (1970), Singh *et al.* (1999), Stary and Bhagat (1978), Stary and Ghosh (1983)
Cajanus cajan	Fabaceae	Ahmad *et al.* (2020), Pandey and Singh (2005), Sharma and Rao (1964)
Capsicum frutescens	Solanaceae	Pandey and Singh (2005)
Cucurbita maxima	Cucurbitaceae	Pandey and Singh (2005), Singh and Tripathi (1987)
Hibiscus sabdariffa	Malvaceae	Ahmad *et al.* (2012)
Lablab purpureus	Fabaceae	Ahmad and Singh (1992-1993, 1996, 2007), Ahmad *et al.* (2020), Subhrani *et al.* (2006)
Lagenaria siceraria	Cucurbitaceae	Ahmad *et al.* (2020)
Lycopersicon esculentum	Solanaceae	Ahmad *et al.* (2012)
Moringa oleifera	Morigiaceae	Ahmad *et al.* (2020)
Phaseolus vulgaris (*Phaseolus sinensis*)	Fabaceae	Ahmad *et al.* (2020), Stary and Ghosh (1983)
Psidium guajava	Myrtaceae	Ahmad and Singh (1992-1993,1995, 1996,1997)
Robinia pseudoacacia	Fabaceae	Bhagat and Ahmad (1991), Subhrani *et al.* (2006)
Solanum melongena	Solanaceae	Singh and Tripathi (1987)
Solanum nigrum	Solanaceae	Bhagat and Ahmad (1991)
Vicia faba	Fabaceae	Ahmad *et al.* (2012), Ahmad *et al.* (2020), Subhrani *et al.* (2006)
Vigna mungo var. *mungo*	Fabaceae	Ahmad *et al.* (2020)
5. *Aphis fabae*		
Clerodendrum infortunatum	Lamiaceae	Ahmad and Singh (2005)
Lagenaria siceraria	Cucurbitaceae	Ahmad *et al.* (2020)
Solanum nigrum	Solanaceae	Ahmad and Singh (2005)
Tagetes erecta	Asteraceae	Ahmad and Singh (2005)
Vicia faba	Fabaceae	Agarwala *et al.* (1980), Singh *et al.* (1999)
6. *Aphis gossypii*		
Abelmoschus esculentus	Malvaceae	Ahmad *et al.* (2012), Ahmad *et al.* (2020), Ahmad and Singh (1997)
Brassica rapa	Brassicaceae	Pandey and Singh (2005)
Cajanus cajan	Fabaceae	Ahmad and Singh (1997), Pandey and Singh (2005)
Capsicum frutescens	Solanaceae	Ahmad *et al.* (2012), Ahmad *et al.* (2020), Pandey and Singh (2005), Singh

		and Tripathi (1987,1988), Subhrani *et al.* (2006)
Clerodendrum infortunatum	Lamiaceae	Ahmad *et al.* (2020)
Coccinia grandis (*Coccinia indica*)	Lythraceae	Ahmad *et al.* (2020)
Colocasia spp.	Araceae	Ahmad *et al.* (2020),
Cosmos spp.	Asteraceae	Stary and Ghosh (1975)
Cucurbita maxima	Cucurbitaceae	Ahmad and Singh (1997)
Eupatorium spp	Asteraceae	Stary and Ghosh (1975)
Hibiscus rosasinensis	Malvaceae	Ahmad *et al.* (2020), Stary and Ghosh (1975)
Lablab purpureus	Fabaceae	Pandey and Singh (2005)
Lagenaria siceraria	Cucurbitaceae	Ahmad *et al.* (2012), Ahmad *et al.* (2020), Ahmad and Singh (1997)
Lawsonia inermis	Lythraceae	Ahmad *et al.* (2012), Ahmad *et al.* (2020)
Luffa aegyptiaca (*Luffa cylindrica*)	Cucurbitaceae	Ahmad *et al.* (2020)
Momordica charantia	Cucurbitaceae	Ahmad and Singh (1997), Ahmad *et al.* (2012), Ahmad *et al.* (2020), Prasad and Prasad (2010)
Ocimum tenuiflorum (*Ocimum sanctum*)	Lamiaceae	Ahmad *et al.* (2020)
Psidium guajava	Myrtaceae	Ahmad and Singh (1992-1993,1994,1996,1997), Ahmad *et al.* (2020)
Rosa sp.	Rosaceae	Ahmad *et al.* (2020)
Rumex sp.	Polygonaceae	Das and Chakrabarti (1989 a,b)
Solanum melongena	Solanaceae	Ahmad and Singh (2007), Ahmad *et al.* (2012), Ahmad *et al.* (2020), Prasad and Prasad (2010), Singh *et al.* (1999), Pandey and Singh (2005)
Solanum tuberosum	Solanaceae	Ahmad *et al.* (2012)
Syzygium cumini	Myrtaceae	Singh *et al.* (1999)
7. *Aphis nasturtii*		
Abelmoschus esculentus	Malvaceae	Ahmad and Singh (1997)
Benincasa hispida (*Cucurbita hispida*)	Cucurbitaceae	Ahmad *et al.* (2012), Ahmad *et al.* (2020)
Cajanus cajan	Fabaceae	Pandey and Singh (2005)
Capsicum frutescens	Solanaceae	Ahmad *et al.* (2012), Ahmad *et al.* (2020), Pandey and Singh (2005)
Chrysanthemum indicum	Asteraceae	Ahmad *et al.* (2020)
Clerodendrum infortunatum	Lamiaceae	Ahmad and Singh (1996)
Clerodendrum viscosum	Lamiaceae	Ahmad and Singh (1997), Ahmad *et al.* (2020)
Ficus religiosa	Moraceae	Ahmad *et al.* (2020)
Hibiscus sabdariffa	Malvaceae	Ahmad *et al.* (2020)
Lablab purpureus	Fabaceae	Pandey and Singh (2005)
Lagenaria siceraria (*Lagenaria vulgaris*)	Cucurbitaceae	Ahmad and Singh (1997), Ahmad *et al.* (2020)
Luffa aegytiaca (*Luffa cylindrical*)	Cucurbitaceae	Ahmad and Singh (1996), Ahmad and Singh (2005, 2007), Ahmad *et al.* (2020), Singh *et al.* (1999), Pandey and Singh (2005)
Lycopersicon esculentum	Solanaceae	Ahmad *et al.* (2020)
Psidium guajava	Myrtaceae	Ahmad and Singh (2005)
Solanum melongena	Solanaceae	Ahmad and Singh (1996, 1997), Ahmad *et al.* (2020), Pandey and Singh (2005)
Tectona grandis	Lamiaceae	Ahmad and Singh (2005, 1995), Ahmad *et al.* (2020), Singh *et al.* (1999)

8. *Aphis nerii*		
Calotropis gigantea	Apocynaceae	Ahmad *et al.* (2020)
Coccinia grandis (*Coccinia indica*)	Cucurbitaceae	Ahmad *et al.* (2020)
Lablab purpureus	Fabaceae	Pandey and Singh (2005)
Nerium oleander (*Nerium indicum*)	Apocynaceae	Ahmad *et al.* (2020)
Solanum melongena	Solanaceae	Ahmad *et al.* (2020), Ahmad and Singh (1996, 1997)
9. *Aphis ruborum longisetosus*		
Rubus ellipticus	Rosaceae	Stary and Ghosh (1975)
10. *Aphis solanella*		
Solanum tuberosum *Capsicum annuum*	Solanaceae	Dharmadhikari and Ramaseshiah (1970), Raychaudhuri (1990)
11. *Aphis spiraecola*		
Ageratum conyzoides	Asteraceae	Ahmad *et al.* (2020)
Bidens pilosa	Asteraceae	Dharmadhikari and Ramaseshiah (1970)
Benincasa hispida	Cucurbitaceae	Ahmad and Singh(1992-1993), Dharmadhikari and Ramaseshiah (1970), Stary and Ghosh (1983), Singh *et al.* (1999)
Cassia fistula	Fabaceae	Ahmad and Singh (1992-1993), Dharmadhikari and Ramaseshiah (1970), Singh *et al.* (1999), Stary and Ghosh (1983)
Chromolaena odorata	Asteraceae	Stary and Ghosh (1975)
Coriandrum sativum	Apiaceae	Ahmad *et al.* (2020), Ahmad *et al.* (2012)
Ipomoea fistulosa	Convolvulaceae	Singh *et al.* (1999)
Lawsonia inermis	Lythraceae	Singh *et al.* (1999)
Mikania cordata	Asteraceae	Dharmadhikari and Ramaseshiah (1970)
Solanum melongena	Solanaceae	Singh *et al.* (1999)
Sonchus spp	Asteraceae	Singh *et al.* (1999)
Tagetes sp.	Asteraceae	Ahmad *et al.* (2020)
Trachyspermum ammi	Apiaceae	Singh *et al.* (1999)
12. *Greenidae formosana*		
Psidium guajava	Myrtaceae	Dharmadhikari and Ramaseshiah (1970)
13. *Liosomaphis himalayensis*		
Berberis sp.	Berberidaceae	Das and Chakrabarti (1989a,b)
14. *Myzus avenae*		
Hordeum vulgare	Poaceae	Singh and Tripathi (1987)
15. *Myzus(Nectarosiphon) persicae*		
Brassica oleracea var. *capitata*	Brassicaceae	Ahmad *et al.* (2012)
Cajanus cajan	Fabaceae	Pandey and Singh (2005)
Capsicum frutescens	Solanaceae	Ahmad and Singh (2007), Pandey and Singh (2005), Singh *et al.* (1999)
Helianthus annuus	Asteraceae	Ahmad *et al.* (2012)
Lablab purpureus	Fabaceae	Pandey and Singh (2005)
Lycopersicon esculentum	Solanaceae	Singh and Tripathi (1991)
Raphanus sativus	Brassicaceae	Pandey and Singh (2005), Singh and Tripathi (1988), Singh *et al.* (1999)
Solanum melongena	Solanaceae	Ahmad and Singh (2007); Parween *et al.* (2023), Pandey and Singh (2005), Singh *et al.* (1999), Singh and Tripathi (1988, 1987)
Solanum tuberosum	Solanaceae	Ahmad *et al.* (2012)
16. *Rhopalosiphum maidis*		

Hordeum vulgare	Poaceae	Dharmadhikari and Ramaseshiah (1970), Singh and Tripathi (1987)
17. *Rhopalosiphum nymphaeae*		
Prunus domestica	Rosaceae	Singh and Srivastava (1990)
18. *Sitobion avenae*		
Hordeum vulgare	Poaceae	Singh and Tripathi (1987)
19.*Tuberolachnus salignus*		
Salix spp.	Salicaceae	Stary and Ghosh (1975)

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Authors Profile

Dr. Md. Equbal Ahmad is Professor, Dept. of Zoology, Tilka Manjhi Bhagalpur University. He has completed his M.Sc. and M.Phil. from A.M.U. Aligarh and did his Ph.D. From DDU, Gorakhpur University. He has more than 30 years of research experience in the field of Toxicology, Bio- ecology and Biosystematics of aphids, their parasitoids and predators. He has received young scientist award by AZRA, Cuttack. He has also completed a major research project of DST. He is a member of editorial Board of several journals.

Nidhi Sinha has completed her M.Sc. degree in Zoology (Entomology) from Tilka Manjhi Bhagalpur University. She is pursuing Ph.D. on Effect of Host plants and parasitoids density on the performance of Lipolexis oregmae Gahan (Hymenoptera: Aphidiidae). She has published two articles in international journal.