References

Ashmead, W. H., Descriptions of new Hymenoptera from Japan. Proc. U. S. Nat. Mus., **30**, 169—201, 1906.

Fahringer, J., Entomologische Ergebnisse der Schwedischen Kamtchatka-Expedition, 1920—1922, 24. Braconidae. Ark. Zool., **21** (A), p. 1—12, 1929.

—, Die Parasiten der Baumläuse (*Lachnini*) aus der Gruppe der *Aphidiinae* Först. Festschr. 60. Geb. E. Strand, Riga, 3, 240—245, 1937.

Förster, A., Synopsis der Familien und Gattungen der Braconen. Verh. naturh. Ver. preuß. Rheinl. Westph., **19**, 225—288, 1862.

Fulmek, L., Insekten als Blattlausfeinde. Ann. naturhist. Mus. Wien, **61**, 110—227, 1957.

Muesebeck, C. F. W., The Genera of Parasitic Wasps of the Braconid Subfamily *Euphorinae*, with a review of the nearctic species. U. S. Dept. Agric. Misc. Publ., No. 241, p. 1—36, 1936.

Stary, P., A Taxonomic Revision of some Aphidiin genera with Remarks on the Subfamily *Aphidiinae*. Acta Faun. Mus. Nat. Pragae, **3**, 53—96, 1958.

Szépligeti, V. G., Braconidae. In: Wytsman, P., Genera insectorum, Fasc. 22, Bruxelles, 1904.

The Life-History in the Field and the Anatomy of fully-grown Larva of *Doliphoceras pseudococci Alam*, an Endoparasite of *Pseudococcus newsteadi Green*

(*Hymenoptera*: *Encyrtidae* & *Hemiptera*: *Coccidae*)

S. Mashhood Alam

Entomology Section, Zoology Department,
Muslim University, Aligarh[1])

(With 8 figures)

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Introduction

None of the species of the genus *Doliphoceras* is so far reported from Great Britain and the genus is for the first time represented in this country by *Doliphoceras pseudo-*

[1]) I am greatly indebted to Prof. O. W. Richards, Dept. of Zoology and Applied Entomology, Imperial College of Science and Technology, London, for permission to work at Silwood Park (Field Station of the College) and for his useful suggestions on the problem.

DOI: 10.21248/contrib.entomol.9.1-2.189-196

cocci Alam. There are several species in this genus but no record on the life-history of any of them is available; and the present paper may rightly be considered as the first record on this aspect of the genus.

Since the advent of the current century some good research papers have appeared on the larval anatomy of the family *Encyrtidae.* Embleton's (1904) paper on *Comys infelix* is the first to be mentioned. She was followed by Imms (1918) with his excellent anatomical paper on *Aphycus melanostomatus Timb.* Later, Smith & Compere (1928) and Thorpe (1936) made worthwhile additions on the larval anatomy of *Metaphycus lounsburyi How.* and *Encyrtus infelix Embleton* respectively. Besides, the researches of the present writer on *Metaphycus taxi Alam* (1957), *Euaphycus variolosus Alam* and *Thomsonisca britanica Alam* unpublished are worth considering. The fact that the larval anatomy of the genus *Doliphoceras* is not yet described, consequently, suggests that the present work is the maiden one on this aspect of the genus.

Habits of the adults

Doliphoceras pseudococci has been reared from *Pseudococcus newsteadi Green.* The latter is commonly found on the branches of *Fagus sylvatica L.* The preimaginal stages of the parasite pass endoparasitic mode of life. The adults are generally prevalent from the fourth week of July till the end of August. They actively fly, especially, on bright sunny days, and can be easily detected on account of their large size and dark colour.

The life-cycle

During bright sunny days mating is of frequent occurrance — a behaviour quite elaborately dealt with by Palley (1943) in *Pseudaphycus orientalis Ferr.*, and by the present writer (1957) in *Metaphycus taxi.* It is followed by egg-laying and only the second nymphal stage of the host is selected for it. Invariably more than one egg is laid per host. The oviposition has no marked effect on the host and the latter continues the normal activities. Besides, she undergoes winter-sleep and continues to remain alive till next May when she does secrete ovisac but fails to lay any egg. This shows that only the fecundity of the host is totally inhibited as a result of parasitism.

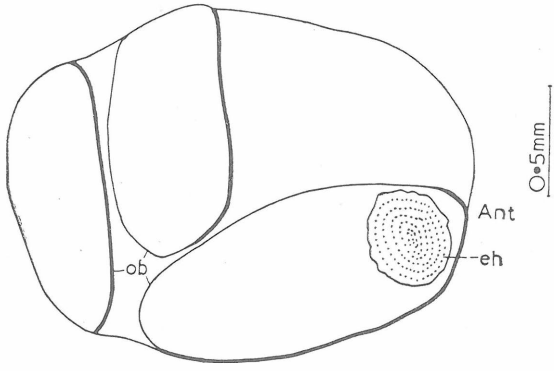

Fig. 1. Dead parasitized *Pseudococcus newsteadi Green.* Ant, anterior end; eh, emergence hole; ob, oblique chambers

The newly hatched larva starts haemophagous mode of feeding. This habit continues during winter-sleep which lasts from November to April next. After winter-sleep the development is accelerated and the larva becomes fully-grown by May and resorts to sarcophagous mode of feeding.

DOI: 10.21248/contrib.entomol.9.1-2.189-196

It is enclosed in a membranous envelope — a feature recorded by the present writer (1957) in *M. taxi*, and also by THORPE (1936) in *Encyrtus infelix*.

The host's body cavity is chambered. The number of chambers tallies with the number of developing larvae, which is usually 4—5 per host. The walls of the chambers are brown, thin and membranous. By the beginning of June the host is definitely dead. The internal chambers become rigid and form oblique bulges in the host's body wall (fig. 1; ob). The pupal stage starts from third week of June. This can be detected by the presence of dark brown pellets lying along the sides of the chambers. The adults commence emergence in the third week of July, making circular holes in host's body (fig. 1; eh). Thus, it is evident that like host the parasite also has only one generation a year.

The distinguishing features of the parasitized coccid

It is very difficult to differentiate between parasitized and unparasitized hosts in early developmental stages of the parasite. Even during hibernation no marked external differences are visible. It is only when the larval development is accelerated that the host can be felt to contain some foreign bodies whose central portions are yellowish. Later on, the uniformity and smoothness of the host's surface are lost as a result of death of the host. Besides, the host is regid to touch due to dried condition of larval chambers in it.

The external anatomy of the larva

The larva is enclosed in a membranous envelope. It is milky white and looks like a long cylindrical curve with both ends clearly bent downwards. The length and the width of the larva are 1.66 mm and 0.705 mm respecti vely. The venter is flat in greater part, but the dorsum is well arched to form the dorsal hump. The head is small and dome-shaped. It is followed by thirteen segmented body with all the segments of the same shape except the thirteenth which is dome-shaped. The first three segments are large but the rest undergo gradual reduction in size. The intersegmental grooves upto tenth segment are distinct but afterwards get faint. A pair of narrow processes, about 0.406 mm long each, are given out from the sides of the tenth segment (fig. 2; pr).

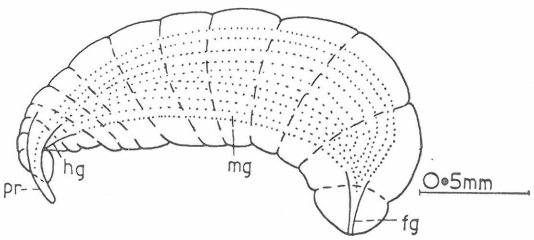

Fig. 2. Lateral view of larva of *Doliphoceras pseudococci Alam.* fg, foregut; hg, hindgut; mg, midgut; pr, lateral process

The head is devoid of antennae. The mouth is located as a small transverse slit slightly lower to the middle of the head. Dorsally it is bounded by clypeo-labral area ventrally by the mid-dorsal margin of the lower wall.

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The clypeo-labral area has two pairs of sensoria and is demarcated from the rest of the facial area by a distinct sclerotic arch (fig. 3; eps) comparable with the typical epistoma of hymenopterous larvae. The ends of the epistoma are in continuity with the short oblique sclerotic pleurostomae (pls) whose posterior processes (x) are distinctly present to provide articulation to the mandibles. The hypostomae look like two oblique, moderately long sclerotic bands (hps), extending on the ventral wall of the head inbetween the pleurostomae and the head rim, and the area, thus enclosed by them, has six pairs of sensoria. At the points of union of the hypostomae with the head rim are the postrior tentorial pits (pt). These pits are connected by a transverse sclerotic rod comparable with the tentorial bar (tb) of hymenopterous larvae as shown by Alam (1952) and Short (1952). The upper half of the head capsule has a pair of sensoria (y) close to the epistoma. A similarpair is on the lower half close to the hypostomae. The mandibles are narrow and elongated with short and slightly curved apices lying parallel to each other (fig. 4).

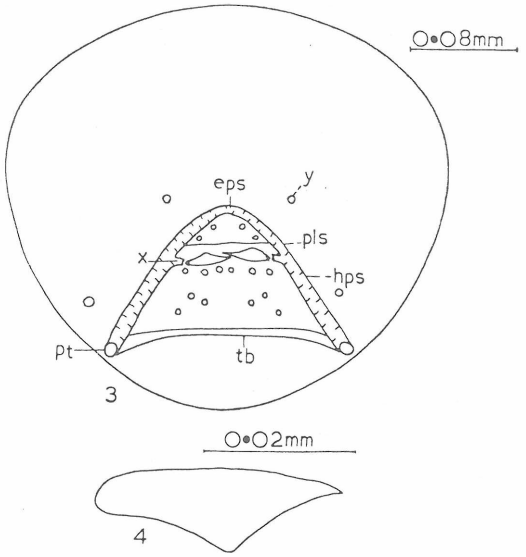

Fig. 3. Facial view of head capsule. eps, epistoma; hps, hypostoma; pls, pleurostoma; pt, posterior tentorial pit; tb, tentorial bar; x, posterior process; y, sensoria. — Fig. 4. Entire mandible

The head capsule appears to be better developed than that of *Metaphycus taxi Alam*, but is much more similar to that of *Thomsonisca brittanica Alam* as shown by the present writer (unpublished). This feature may be taken as a reliable generic character to connect *Thomsonisca* Ghesquière with *Doliphoceras* Mercet. Further, comparing the head capsule of *D. pseudococci* with that of *Stenobracon deesae* Cam., as shown by the present writer (1952), it can conveniently be suggested that the family Encyrtidae is better evolved than the family Braconidae.

The internal anatomy of the larva

The digestive system (fig. 2): This system follows the shape of the larval body with both ends clearly directed downward. The foregut (fg) is short and narrow and opens at the apex of the head as larval mouth. It is in continuity with the midgut in the first body segment. The midgut (mg) is oblong, extends from segments 1—11 and occupies the major portion of the

DOI: 10.21248/contrib.entomol.9.1-2.189-196

body cavity. It appears yellowish on account of food contained in it. The tubular hindgut (hg) extends like a curve from the 11th. segment to the apex of the 13th. segment where it opens by the anus. The lumen of the hindgut has no communication with the midgut.

The salivary glands (fig. 5): A pair of thick, long and convoluted salivary glands are present (sgl). These lie free in the body cavity, ventrolateral to midgut, and extend up to the 10th. segment with their rounded blind ends lying on either side of the fourth ganglion. The glands in the first segment form two convergent narrow lateral salivary ducts which, before entering the head capsule, fuse to form the common salivary duct (csd). The latter traverses the head capsule, passing in between the brain and the suboesophagealganglion, to open on the floor of the mouth.

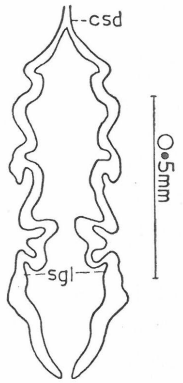

Fig. 5. Salivary glands. csd, common salivary duct; sgl, salivary glands

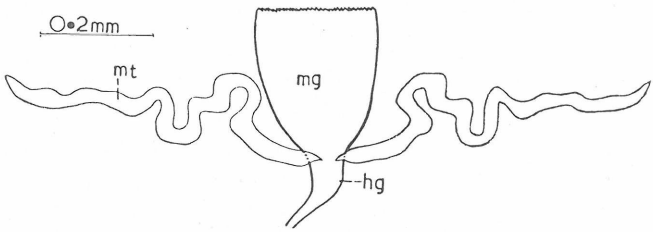

Fig. 6. Ventral view of incomplete midgut-cum-hindgut. hg, hindgut; mg, midgut; mt, malpighian tubule

The excretory system (fig. 6): The two malpighian tubules are thick and convoluted (mt). These lie free in the body cavity, ventral to the midgut (mg), and flanked on sides by the salivary glands. These open by narrow ends into the hindgut (hg) at its junction with the midgut.

The respiratory system (fig. 7): The two lateral trunks take up mid-longitudinal course in segments 1—10. These (lt) are deeply embedded in the body cavity hence are not visible externally. Anteriorly, these enter the head capsule and branch off. Posteriorly, the trunks enter into the respective lateral processes of the tenth segment, extend upto their apices but develop no communication with the exterior. Before entering the processesthe trunks give out two branches to ramify in segments 10—13. Eight pairs of distinct

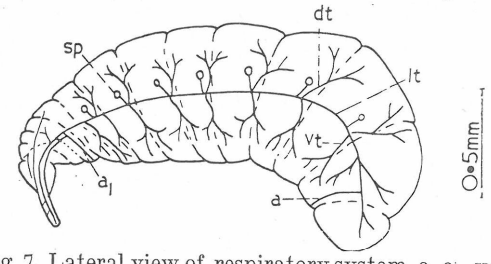

Fig. 7. Lateral view of respiratory system. a, a_1, ventral tracheal commissures; dt, dorsal trachea; lt, lateral trunk; sp, spiracle; vt, ventral trachea

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circular spiracles are borne in the antero-lateral areas of terga 2—9 (sp). The spiracles are connected with the anterior portion of the lateral trunks, in their respective segments, by short narrow spiracular tubes. In each spiracle bearing segment a pair of dorsal tracheae is given out, slightly anterior to the spiracular tube (dt). The dorsal tracheae take up ascending course to ramify in the dorsal area of their own segment, as well as, that of the immediately preceding one. Similarly, in each spiracle bearing segment paired ventral tracheae (vt) come out from the ventral surface of the trunks and supply branches to the venter like the dorsal branches. In the first segment the trunks are connected by a ventral commissure (a). A similar commissure connects the trunks in the tenth segment (a_1) before their entry into the lateral processes. The respiratory system as such when compared with that of *Stenobracon deesae Cam.*, as shown by the present writer (1952), appears to enjoy a higher evolutionary status.

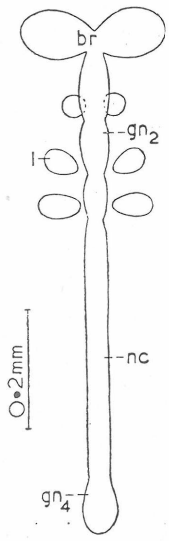

Fig. 8. Nervous system. br, brain; gn_{1-4}, ganglionic centres; l, leg bud; nc, ventral nerve cord

The nervous system (fig. 8): The brain is small and bilobed with distinct central constriction (br). It is connected with a very small suboesophageal ganglion through circumpharyngeal connectives. The ventral nerve cord is moderately thick, milky white and extends upto the tenth segment. It possesses three ganglionic swellings (gn) in the first three segments. Theseare guarded on sides by paired leg buds of their respective segments (l). Thes apex of the cord in the tenth segment is distinctly dilated to form the fourth ganglionic centre (gn_4). This system appears to be better evolved than that of *Stenobracon deesae* (*Braconidae*), when the number of ganglionic centres on the ventral nerve cord of the two species are compared.

The importance of the parasite

A study of the life-cycle of *D. pseudococci* and its host suggests perfect adaptation of the parasite to the environment. Such adjustments rule out the possibility of setting in of an unfavourable period-like host free period-during the life-cycle of the parasite. Secondly, the host-parasite relationship shows thet the host is attacked at a stage when it is liable to cause great damage to the host plant. Thirdly, the fecundity of the host is completely inhibited. Fourthly, the percentage of successful parasitization is fairly satisfactory and constant (Table 1). Lastly, so far no competitor or hyperparasite of *D. pseudococci* is recorded. Consequently, this parasite can be recommended for trial in the biological control of *P. newsteadi*.

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Table 1. Showing percentage of parasitism of *Doliphoceras pseudococci Alam* on *Pseudococcus newsteadi* Green at Silwood Park

Date of examination	No. of coccids examined	No. of parasitized coccids	Percentage of parasitism
June and July 1953	300	87	29
June and July 1954	200	62	31

Summary

Doliphoceras pseudococci Alam is an endoparasite of *Pseudococcus newsteadi Green*. The latter is a well known pest of *Fagus sylvatica L.* Both the host and the parasite has one generation a year with their different stages well adjusted to bring about stable hostparasite relationship. The latter has some significant features which suggest utilization of *D. pseudococci* in the biological control of *P. newsteadi*. As many as five larvae are found developing in one host. The larvae gradually get enclosed in separate membranous envelopes which, later on, dry up to form rigid chambers for pupation.

The larval anatomy incorporates both the external and internal structures. The presence of distinct similarity in the head capsules of *Thomsonisca britanica Alam* and *Doliphoceras pseudococci Alam* suggests probable close relationship of the two genera. The tenth segment possesses a pair of lateral processes. The structure of the head capsule supported by the nature of the respiratory and nervous systems suggests a higher evolutionary status to Encyrtidae over Braconidae.

Zusammenfassung

Beschrieben werden Lebenszyklus von *Doliphoceras pseudococci Alam*, Morphologie und Anatomie der Larve und die Bedeutung als Parasit von *Pseudococcus newsteadi Green*. Die Verwandtschaft von *Thomsonisca* und *Doliphoceras* wird auf Grund der Ähnlichkeit der Kopfkapsel erörtert. Ein höherer Entwicklungsstand der Encyrtiden gegenüber den Braconiden wird auf Grund des Atmungs- und Nervensystems vermutet.

Резюме

Описываются жизненный цикл *Doliphoceras pseudococci Alam*, морфология и анатомия личинки и значение *Pseudococcus newsteadi Green*, как паразита. На основе сходства черепной коробки обсуждается родство между *Thomsonisca* и *Doliphoceras*. По данным дыхательной и нервной систем предполагают, что уровень развития Encyrtidae выше чем Braconidae.

References

Alam, S. M., A contribution to the Biology of *Stenobracon deesae* Cameron (*Braconidae, Hymenoptera*) and the Anatomy of its pre-imaginal stages. Ztschr. Parasitenk., **15**, 159—182, 1952.

—, The Biology of *Metaphycus taxi Alam* (*Encyrtidae, Hymenoptera*) in the constant temperature room with notes on the Anatomy of its pre-imaginal stages Ind. Journ. Ent. **19**, 231—240, 1957.

—, The Life-history in the Field and the Anatomy of fully-grown Larva of *Thomsonisca britanica* Alam (*Hymenoptera, Encrytidae*)- an endoparasite of *Chionaspis salicis* Lin. (*Hemiptera, Coccidae*). (Unpublished.)

—, The Life-history in the Field and the larval Anatomy of *Euaphycus variolosus* Alam (*Hymenoptera, Encyrtidae*)- an endoparasite of *Asterolecanium variolosum* (Ratzb.) (*Hemiptera, Coccidae*), (Unpublished).

Embleton, A. L., On the anatomy and development of *Comys infelix* Embleton, a hymenopterous parasite of *Lecanium hemisphaerica* (Targioni). Trans. Linn. Soc. Lond. (Zool)., (2) **9**, 231—254, 1904.

DOI: 10.21248/contrib.entomol.9.1-2.189-196

Flanders, S. E., *Metaphycus helvolus*, an Encyrtid parasite of the black scale. Journ. econ. Ent., **35**, 690—698, 1942.
Imms, A. D., Observations on the Insect parasites of some Coccidae. II. On Chalcid-parasites of *Lecanium capreae*. Quart. Journ. micr. Sci., London, **63**, 293—374, 1918.
Le Palley, R. H., An oriental mealy bug (*Pseudococcus lilacinus* Ckll.), (Hemiptera) and its insect enemies. Trans. R. ent. Soc. Lond., **93**, 73—93, 1943.
Short, J. R. T., The morphology of the head of larval Hymenoptera with special reference to the head of Ichneumonidea, including a classification of the final instar larvae of the Braconidae. Trans. R. ent. Soc. Lond., **103**, 27—84, 1952.
Smith, H. S. & Compere, H., A preliminary report on the insect parasite of the black scale, *Saissetia oleae* (Bernard) Univ. Calif. Publ. Ent., **4**, 231—334, 1928.
Thorpe, W. H., On the new type of respiratory interrelation between an insect (Chalcid) parasite and its host (*Coccidae*). Parasitol., **28**, 517—540, 1936.

Bryophila divisa Esp., Ocnerostoma copiosella Frey, Depressaria eremitella Stt., neu für Nordost-Deutschland

(*Lepidoptera*)

Gerrit Friese

Deutsches Entomologisches Institut
der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin
Berlin-Friedrichshagen

(Mit 2 Textfiguren)

Die Umgebung Berlins zählt unzweifelhaft zu den lepidopterologisch am besten besammelten Gebieten Deutschlands. Namhafte Lepidopterologen haben hier ihr Leben lang geforscht und man sollte annehmen, daß es, abgesehen von einigen Einwanderern, kaum noch neue Arten zu entdecken gibt. Nachdem es mir bereits 1957 gelang, einen für unser Gebiet neuen Tagfalter aufzufinden[1]), kann ich heute drei weitere Neufunde bekanntgeben. Diese Arten dürften wohl kaum zu den Neueinwanderern gehören wie z. B. *Cucullia fraudatrix Ev.* oder *Eupithecia sinuosaria Ev.*, die unseren Raum erst in den letzten Jahrzehnten besiedelt haben. Sie sind sicher schon immer hier bodenständig gewesen, doch wegen ihrer Unscheinbarkeit oder infolge Verwechselungen mit anderen Arten bisher der Beobachtung entgangen.

Bryophila divisa Esp. (*raptricula Hbn.*)

(*Noctuidae*)

Diese Art fand ich in zwei männlichen Exemplaren in Berlin-Friedrichshagen am Licht (Schaufenster), und zwar am 3. VIII. 1957 und 18. VIII. 1958. Weitere Funde teilte mir inzwischen Herr Dr. Cleve mit: je ein Falter Wedding, 8. IX. 1956, Spandau, 8. VII. 1957 und Wilmersdorf,

[1]) Friese, G., *Philotes* (*Lycaena*) *vicrama Moore* in Brandenburg. Mitt. Dtsch. ent. Ges., **16**, 23—24, 1957.

DOI: 10.21248/contrib.entomol.9.1-2.189-196