

PSYLLIDAE OF THE INDIAN SUBCONTINENT

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KEY TO THE GENERA OF PSYLLINAE

1. Forewings strongly rhomboidal, usually thickened and opaque; vertex flat; genae produced into two transverse, contiguous lobes, on the same plane with vertex *Euphyllura*
- Forewings elongate-ovate, sometimes with a rhomboidal tendency, usually hyaline or subhyaline, rarely opaque; genal cones not as above 2
2. Pleural suture of prothorax extending to middle of lateral extremity of pronotum, which is more or less swollen and knob-like; propleurites subequal in length; antennae seldom long, usually very short 3
- Pleural suture of prothorax extending obliquely to posterior part of lateral extremity of pronotum, not attaining to it at all; episternum longer than epimeron; genal cones various, usually conical; antennae at least longer than width of head *Psylla*
3. Vertex large, flat, with eyes strongly recessive; genal processes in same plane with vertex, flat; wings rhomboidal, often subopaque, with closed pterostigma 4
- Vertex smaller, less flat, with eyes less recessive; genal cones not as above; wings usually subopaque to hyaline 5
4. Genal cones large, broad, usually quadrate; forewings rounded or somewhat angulate at apex *Euphalerus*
- Genal cones large, thick, as long as or longer than broad, porrect, apices narrowly rounded or truncate; forewings broad subapically, rounded at apex, narrow in basal half *Diaphorina*
5. Genal cones rounded at apex; male proctiger simple *Arytaina*
- Genal cones roundly swollen, widely separated; male proctiger with a secondary process *Acizzia*

This sub-family contains a number of small free-living species, exhibiting a number and sequence of generations in a year. The generations vary within wide limits, and as many as 11 generations have been recorded for *Psylla simlae* Crawf. (Mathur, 1935). They feed on young leaves and are able to breed continuously during the active season so long as new buds or foliage are available. Their numbers and intensity of attack decrease by the heavy rainfall during the monsoon season. Some of the species are perfectly naked, but others are enveloped or sheltered under a flocculent or woolly exudation or surrounded with waxy filaments produced from glands along the outer margin of the body. The eggs are generally laid all over the tips of the young foliage and fresh buds. In severe infestations, all stages of the species are met with. The nymphs excrete honey dew excessively, resulting in the whole foliage and branches of the tree being heavily smothered with the exudation. This sugary coating is attacked with a fungus which covers it with a smutty black coat seriously injuring the tree.

Genus **ACIZZIA** Heslop-Harrison 1960*Acizzia*

- Heslop-Harrison, G. 1951. *Ann. Mag. nat. Hist.* (12), 4(41): 417.
 Heslop-Harrison, G. 1960. *ibid.* (13), 3(31): 417-418.
 Loginova, M. M. 1967. *Ann. Natur. Mus. Wien.*, Bd. 70: 404-405.

Neopsylla

- Heslop-Harrison, G. 1949. *Entomologist's mon. Mag.* 85: 161-162.

Psylla

- Maskell, W. M. 1894. *Entomologist's mon. Mag.* 30: 171.

Type species. *Diaphorina putonii* Loew (= *Diaphora putonii* Loew 1878) (original designation); recorded from Italy and Greece.

The distinctive characters outlined by Loew (1878), Crawford (1924) and others are expanded with the notes given below.

Body generally long and slender, and covered over with mealy waxy secretion. Head narrower than thorax, usually punctate, scarcely deflexed; vertex flat, and generally broader than long. Frons concealed by genal cones dorsally but visible ventrally as a large plate. Genal cones large, thick, as long as or longer than broad, porrect, extending forward in the same plane with vertex or nearly so, apices narrowly rounded or truncate. Eyes large, recessive. Antennal sockets scarcely visible. Antennae very short, moderately thick, usually ten-segmented, about as long as width of head or less. Thorax moderately narrow and slender, moderately arched, punctate, dorsal surface more or less granulate ('gekornelt'). Legs of medium size, pubescent with strong setae, hind tibiae with black, tooth-like spines at apex, varying in number in different species; proximal tarsal segment of hind leg with two stout, claw-like spines at apex. Forewings long and large, membrane sub-hyaline and thickened, usually maculated extensively with brown, broad sub-apically, rounded at apex, narrow in basal half, pterostigma long and very narrow or wanting, radial sector quite long and flexed near apex, radius as long as or longer than basal vein, cubitus longer than radius, second marginal cell larger than first.

There are 9 species including 5 new to science, representing this genus in India. Their distinguishing characters are presented in the key.

KEY TO THE SPECIES OF DIAPHORINA

1. A cross vein present, connecting the radial sector, and the first medial branch *D. venata*, sp. n.
- No such cross vein 2
2. Colour smoky black or fuscous; wings entirely maculated with black, scattered maculae, intermixed with small hyaline areas 3
- Colour yellowish-brown, brown or orange, with greenish tinge; wings partly maculated 7
3. Genal cones narrowly rounded at apex 4
- Genal cones truncate at apex *D. truncata* Crawford.
4. Genal cones smaller or as long as vertex along median suture. 5
- Genal cones longer than vertex *D. dunensis*, sp. n.
5. Maculae dense and composed of small scattered spots, inter-mixed with hyaline areas *D. communis*, sp. n.
- Maculae less dense 6
6. Second marginal cell longer than first *D. enderleini* Klimasz.
- Second marginal cell as long as first *D. cardiae* Crawford.
7. Apical band in forewing continuous from apex of radial sector to marginal cells 8
- Apical band interrupted in medial cell *D. gymnosporiae*, sp. n.
8. Media and cubitus banded with maculae *D. bikanerensis*, sp. n.
- Media and cubitus without bands *D. citri* Kuw.

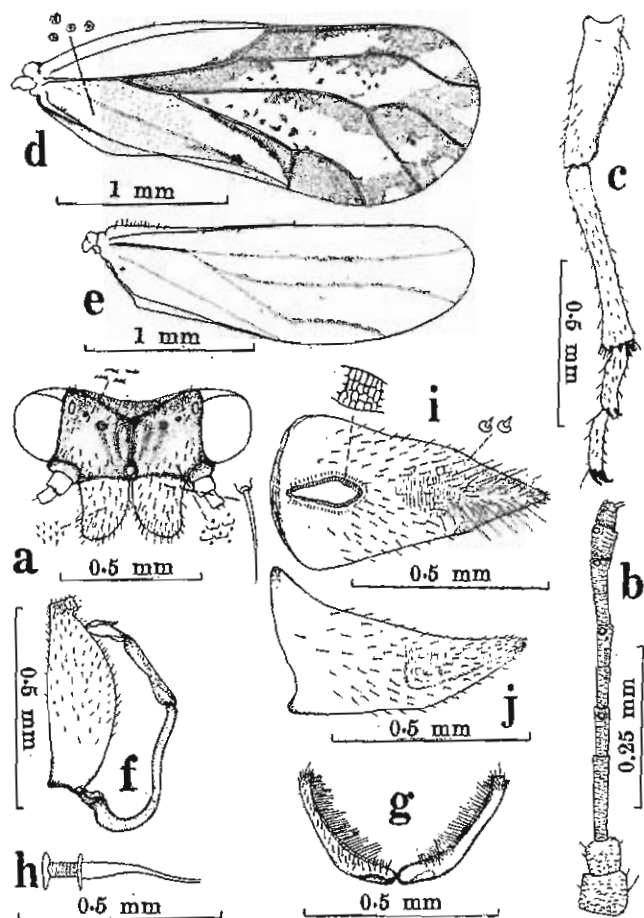


Fig. 56. *Diaphorina bikanerensis*, sp. n.—a: head, front view; b: antenna; c: hind leg; d: forewing; e: hind wing; f: anal valve and aedeagus of male, lateral view; g: forceps, caudal view; h: sperm pump; i: dorsal plate of female; j: ventral plate, lateral view.

***Diaphorina bikanerensis*, sp. n.**
(Fig. 56)

Length of body, in male, 1.82 mm; in female, 2.2 mm;
Length of forewings, in male, 2.6 mm; in female, 2.6 mm
Width of head with eyes, 0.83 mm
Width of vertex between eyes, 0.48 mm
Length of antennae, 0.60 mm

Colouration. General colour yellowish-brown, dorsum and lateral sides of thorax and lateral sides of abdomen greyish; head yellowish-brown with posterior border margined

black; prothorax in middle, anterior area of prescutum and two pairs of longitudinal stripes on scutum dark brown; genae greyish; antennae yellowish-brown with two apical segments black; hind to forelegs progressively light to dark brown or blackish; metacoxal spur dark brown; meracanthus lighter; female genitalia yellowish-brown and blackish posteriorly.

Structure. Body long and slender. Head (**Fig. 56a**), including eyes, almost as broad as thorax, moderately deflexed; vertex sparsely pubescent, finely rugulose, finely punctate, about twice as broad as long, with two pairs of foveal impressions on each side of median suture, posterior to centre, from each anterior fovea a shallow depression extending anteriorly towards the median suture, but not attaining the anterior margin, posterior foveae minute and circular, disc slightly swollen on either side of median line; post-ocellar region swollen, post-ocelli large and lateral; posterior border margined and strongly emarginate; anterior ocellus visible from above; frons visible, surrounding the front ocellus; genal cones large, about 0.18 mm long and as long as vertex, directed forward, on the same level as the vertex but distinctly separated by the deep impressed line, separate but approximate, apices divergent and roundly pointed, pubescent and finely rugulose and also armed with minute points. Eyes large and recessive. Antennal sockets large and located just below the lower margin of eyes.

Antennae (**Fig. 56b**) small, thick, bearing few setae, two basal segments robust, 1st broadly transverse, 2nd almost quadrate and as long as 1st, 3rd segment longest, about twice as long as 5th, 4th slightly more than half as long as 3rd and a little longer than 5th, 5th and 6th equal, 7th, 8th and 9th equal to one another and each slightly smaller than 6th, terminal segment smaller than 9th, bearing two apical spines, 9th segment thicker than others, four sensoria present on segments 4, 6, 8 and 9.

Thorax strongly arched, finely and sparsely pubescent, finely punctate, and finely beset with minute points. Pronotum flat, as wide in the middle as at the sides, with two subequal, lateral foveal impressions, disc convexly rounded, descending, in the same plane as prescutum; prescutum gradually sloping anteriorly, broader than long, a little more than one and a half times as broad as long, broadest in middle, narrower both anteriorly and posteriorly, angulate laterally and posteriorly; scutum large and broad, a little longer than presentum, about two and a half times as broad as long, anterior margin concave, disc swollen submedianally, forming a shallow longitudinal median channel, sloping and angulate laterally, posterior margin angulate submedianally; scutellum narrowly transverse, saucer-shaped, with prominent antero-lateral angles, about twice as broad as long.

Legs (**Fig. 56c**) long and robust, coarsely pubescent, tibiae longer than femora and each having an apical comb of setae, without basal spur, with six black, tooth-like spines at apex; basal tarsal segments smaller than apical; meta-basal tarsal joint with two black claw-like spines at apex; tibial grooves quite long; meracanthus large and subtriangular.

Forewings (**Fig. 56d**) long, narrow at base, rounded at apex, broadest subapically, about two and a half times as long as broad, maculated in all cells except C+Sc, the maculae forming large bands, leaving clear areas in between and small clear spots along the apical margin, costal margin angulate apically, pterostigma long, narrow and pubescent, radius

longer than basal vein, cubital petiole about half as long as radius, cubitus slightly longer than radius, radial sector almost running parallel to costal margin and then abruptly flexed downwards near apex, marginal cells unequal, first cell smaller than second, veins with two rows of microscopic setae; fork M_{1+2} with a weak loop.

Hind wings (**Fig. 56e**) slightly smaller than forewings, membrane uniformly beset with minute points, costal margin armed with a few simple and hooked setae in the basal half.

Abdomen long and narrow, finely and sparsely pubescent, and also armed with minute points, pubescence longer on sternites.

Genitalia. Male genitalia smaller than abdomen. Anal valve (**Fig. 56f**) about 0.5 mm long, longer than parameres, in profile, anterior margin almost straight or weakly convex, posterior margin broadly convex and slightly invaginated near apex, valve narrower both apically and basally, truncate at apex, somewhat pear-shaped when viewed anteriorly, outer surface sparsely beset with small, thick setae; parameres (**Fig. 56g**) about 0.35 mm long, slender, bowed, narrower apically and wider near base, sides subparallel, terminating in an acute, thick black point, outer surface sparsely beset with minute setae, mesal margins bearing long, numerous setae, apices armed with a group of small setae, directed downwards; hypandrium simple, of usual shape, having sparse setae; aedeagus (**Fig. 56f**) elbowed, outer arm smaller than basal, spoon end simple; sperm pump as figured (**Fig. 56h**).

Female genitalia smaller than abdomen; plates sub-equal, broad basally and gradually narrowed caudally; dorsal plate (**Fig. 56i**) a little longer than ventral, roundly pointed apically, pubescent, with six pairs of long setae in the posterior third and also thickly armed with minute peg-like setae on lateral sides, setae in middle smaller; circum-anal pore ring composed of a narrow band of pores and guarded by minute setae; ventral plate (**Fig. 56j**) acutely pointed apically, coarsely pubescent in the posterior two-thirds, with a bunch of minute setae near apex; ovipositor acutely pointed.

Host plant. Collected on *Leptadenia spartium* White.

Type locality. Bikaner (Rajasthan).

Types. Described from a small series of dry specimens, which were represented mostly with females, antennae missing in all specimens and legs in few, one dislodged antenna mounted on slide. Holotype female, of 8.11.68 from the type locality (Sawai Singh); Paratypes: 4 females of 8.11.68, from the type locality (Sawai Singh). All types deposited at F.R.I., Dehra Dun. One male specimen from the same lot, was dissected and its parts were mounted on slide. Two paratypes are deposited at the Department of Zoology-Entomology, Punjab Agricultural University, Ludhiana.

Comparison. This species is separated from other species of *Diaphorina* by the different pattern of maculations in the forewings, shape of head and genal cones and second marginal cell of forewing; genae separate but approximate, with apices divergent and rounded. In wing maculations, this species somewhat resembles *D. gymnosporiae*, but the pattern is different.

Biological notes. Nothing is known about its biology and economic importance, except

that the species has been collected on *Leptadenia spartium*, from Bikaner (Rajasthan) on 8th November 1968 (Sawai Singh).

***Diaphorina cardiae* Crawford 1924.**

(Figs. 57, 58)

Crawford, D. L. 1924. *Rec. Indian Mus.* 26(6): 617.

Ramakrishna Ayyar, T. V. 1924. *Rec. Indian Mus.* 26(6): 624.

Husain, M. A. and Dina Nath, 1927. *Mem. Dep. Agric. India Ent. Ser.* 10(2): 9.

Length of body, in male, 2.15 mm; in female, 2.35 mm

Length of forewings, in male, 2.05 mm; in female, 2.10 mm

Width of head with eyes, 0.62 mm

Width of vertex between eyes, 0.35 mm

Length of antennae, 0.47 mm

Colouration. This species shows considerable variation in wing pattern and colouration and the following description has been made from the North Indian specimens. General colour pale-orange, head orange, genae pale-yellow dorsally, slightly darker apically and ventrally, antennae pale-yellow, two basal joints dark-brown, apex of joint 8 and two terminal segments black, prothorax black anteriorly, prescutum with a broad, anterior band and scutum with two pairs of bands of dark-brown colour, legs pale-yellow except femora, femora of fore and middle legs dark brown, and of hind leg lighter, basal portion of tibiae and apical tarsal joints dark-brown, spines black, claws black, abdominal tergites dark-brown, sternites pale-yellow, with two distinct dark-brown longitudinal stripes, genitalia dark-brown, anal ring orange, forewings with maculae numerous and scattered, but concentrated mostly in the outer half of the wing.

Structure. Body long and slender. Head (Fig. 57a) scarcely declivous, finely punctate, including eyes, slightly smaller than thorax; vertex flat, slightly more than two and a half times as broad as long, sparsely pubescent, deeply emarginate at the posterior margin, weakly swollen on either side of median suture, with an oval fovea on each side of median line, near the posterior margin, without shallow linear depression, anterior ocellus visible from above and located at the point of excision; genal cones on the same level as the vertex, separate, about 0.15 mm long and as long as wide and nearly as long as vertex, diverging slightly outward, rounded at tip, more pubescent than vertex. Eyes large and recessive. Antennal sockets lateral and situated on level with the lower margin of eyes.

Antennae (Fig. 57b) small and thick, ten-segmented, bearing a few setae, first two joints robust, 1st slightly broader than long, 2nd quadrate, slightly smaller than 1st, remaining segments imbricate and progressively becoming thicker from third to apex, 3rd segment longest, 4th, 5th and 6th equal to one another, 7th and 8th equal but smaller than 6th, penultimate joint slightly wider than the terminal, terminal segment with two unequal, apical spines, four sensoria present on segments 4, 6, 8 and 9.

Thorax somewhat arched, robust, finely punctate, sparsely pubescent. Prothorax flat, viewed dorsally, longer in middle and narrower laterally, with two subequal foveal impressions on each side; prescutum viewed dorsally, about twice as broad as long, broadest in middle, gradually sloping anteriorly, bluntly angled laterally, and also distinctly

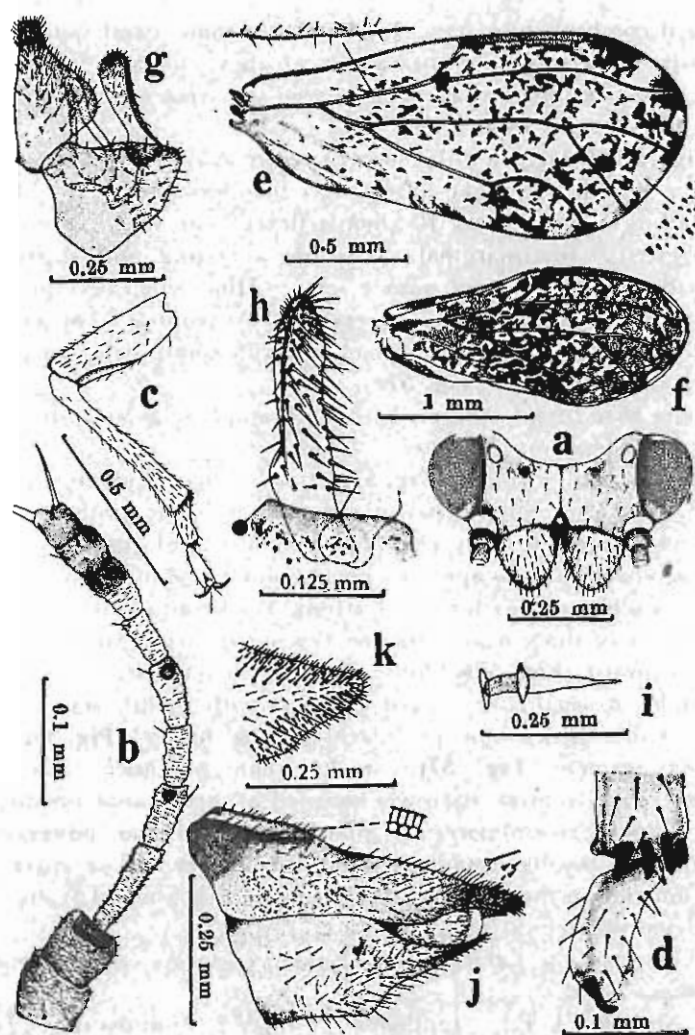


Fig. 57. *Diaphorina cardiae* Crawford.—a: front view of head; b: antenna; c: hind leg; d: part of hind leg, showing number and arrangement of apical spines on tibia; e: forewing; f: forewing (from S. Indian specimen); g: lateral view of male genitalia; h: forcep, mesal view; i: sperm pump; j: lateral view of female genitalia; k: caudal end of dorsal plate, dorsal view.

angled submedianally on the posterior margin; scutum large, broad, and convex, about twice as broad as long, broadest before middle, slightly longer than prescutum, angled both laterally and posteriorly; scutellum small and transverse, vase-shaped, about twice as broad as long, broad anteriorly, with prominent antero-lateral angles; mesepisternum large and directed forward.

Legs (Fig. 57c) of medium size, coarsely pubescent, femora shorter than tibiae, all

tibiae with apical comb of stout setae, hind tibiae without basal spur and with about seven short, stout, black spines on the margin at apex, similarly basal tarsal segment with two black claw-like spines at apex, metacoxal spur (meracanthus) of medium size, acutely conical, tibial groove quite long.

Forewings (**Figs. 57d,f**) large, a little more than twice as long as wide, widest subapically, rounded at apex, stem R about one-third longer than basal vein (R+M+Cu), cubital petiole about half as long as radius, Rs slightly flexed near apex, pterostigma long and narrow and pubescent, first marginal cell as long as second and slightly wider than second, veins with a double row of minute setae. Hind wings also quite large. Both fore and hind wings beset with microscopic setae (minute points). The wing of S. Indian specimens (**Fig. 57f**) are more densely maculated with small, irregular specks than the wings of North Indian specimens (**Fig. 57e**).

Abdomen longer than broad, sparsely beset with simple setae and thickly with minute points ventrally, setae longer on sternites.

Genitalia. Male genital segment (**Fig. 57g**) smaller than abdomen, pubescent, anal valve about 0.32 mm long, longer than parameres, in profile, anterior margin weakly convex, lateral lobes large, broadly rounded in middle, and gradually narrowed both basally and apically, attenuate at apex; parameres about 0.28 mm long, broadly rounded at apex in profile, each forcep with a small, strong, black tooth at its extremity and surrounded by a cluster of thick setae, setae on the mesal surface and on margins longer and directed downward (**Fig. 57h**), outer surface beset with small simple setae; hypandrium simple, of usual shape, sparsely beset with simple setae; outer arm of aedeagus small, with a thick spoon end; sperm pump as figured (**Fig. 57i**).

Female genital segment (**Fig. 57j**) smaller than abdomen, coarsely pubescent. Dorsal plate longer than ventral, narrowly rounded at apex, anal opening surrounded by an oval ring of double row of pores and guarded by small setae, posterior region (**Fig. 57k**) armed with thick peg-like setae, setae in centre longer and arranged in two rows, ventral plate acuminate in the posterior region and acutely pointed at apex, both plates broad basally; ovipositor acutely pointed.

Host plants. Collected on *Cordia grandis* Roxb. (= *Cordia cordata* Steud.), *C. myxa* Linn., and *C. obliqua* Willd.

Distribution. Aligarh (U.P.), Ludhiana (Punjab), Coimbatore (Tamil Nadu), Nagpur (Maharashtra).

Material examined. Numerous adults and nymphal stages collected on February 2, 1937, from Aligarh, U.P., on *Cordia myxa* (R.N. Mathur); some adults with nymphal stages, received on June 15-16, 1960, from the Professor of Zoology and Entomology (S. Singh), Punjab Agricultural University, Ludhiana, and from this collection, 4 males and 7 females (R.R.D. 2504), and 6 males and 5 females were later mounted on cards; in February 1965, few examples, in poor condition, were received from the Entomologist and Associate Professor of Entomology, Agricultural College and Research Institute, Coimbatore (Tamil Nadu). These specimens were collected on *Cordia obliqua* Willd. and *C. myxa* Linn., during 1915, 1917, 1923 and 1936, from Coimbatore. They are provisionally identified as *Diaphorina cordiae* Crawford. The writer had also examined the material

present at the Indian Agricultural Research Institute, New Delhi, having this data: 4 examples, Coimbatore, S. India, July 22, 1912 (T.V.R.), on *Cordia*, and 8 examples from the same locality, collected on August 25, 1915 (Fletcher). They are also *D. cordiae* Crawf.

Comparison. Crawford (1924) described this species from specimens collected from Coimbatore (S. India) and his description is very meagre. It was noted that the examples represented in S. India possess darker wings and are densely covered with brown maculae than those collected from N. India. *D. cordiae* Crawf. differs from other species in wing pattern, shape of genal cones and genital structures. Two pairs of *D. cordiae* collected from N. India were sent to Dr Russell for comparison with the Crawford's type material present at the U.S. National Museum. She writes (*in litt.*), "*Diaphorina* sp., not *cordiae* Crawf.—In *cordiae* the ♀ ventral valve of the ovipositor is turned upward at a right angle; the ♂ forceps are parallel sided in lateral view, and the distal portion of the proctiger appears to be longer in relation to the basal portion than in your specimens. The cubital and medial cells are slightly different in shape and radius is more strongly curved than in your specimens". Personally, I am inclined to think from the materials (north and south India) examined by me that the differences are very minor and that the two collections should be referred to the same species. Besides, the host plants of both the collections, are species of *Cordia*. The major difference is in colouration and relative distribution of brown maculae in forewings.

Biological notes. This is a free living species, infesting young leaves and twigs; the adults are quite active and fly about with a slight disturbance. The nymphs are chrome orange or pale cadmium yellow, with smoky wing-pads, and their characters are described below.

Nymphal stages

Fifth stage. (Fig. 58a). Length 1.65 mm. Body oval; the wing-pads moderately large, projecting from the side of the body, the humeral angle produced cephalad, reaching the level of the lower margin of eyes, each wing-pad with clavate setae arranged along the margin and also with a single lanceolate seta near the posterior angle; eyes prominent. Dorsum strongly sclerotized throughout, having some thoracic and abdominal plates as illustrated, these plates are separated mesally by a narrow strip, except the large posterior abdominal plate, indicating traces of segmentation. Entire margin of abdomen armed with a continuous series of lanceolate setae. Derm thickly beset with minute points and sparsely with clavate setae.

Ventral side membranous throughout, except the anal plate, with one lateral area, a small area about each spiracle and four pairs of small submedian areas. Derm thickly beset with minute points. Simple ring-based setae present intersegmentally in the abdomen. Antennae (Fig. 58b) borne at the margin of the head, about 0.35 mm long and armed with a few simple setae, three-segmented, the first two basal segments distinct, quite short, 3rd segment longest, not differentiated into segments, bearing three lanceolate setae, four sensoria and two unequal, thick terminal spines. Legs (Fig. 58c) long and well developed, bearing a few simple setae, without trochanter, with tibio-tarsal articulation

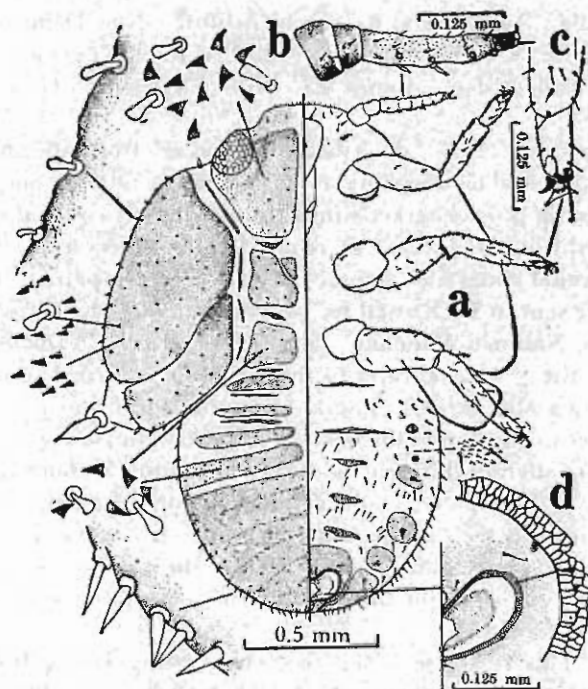


Fig. 58. *Diaphorina cordiae* Crawl.—a: fifth stage nymph; b: antenna; c: part of leg; d: part of circum-anal ring.

well-defined, tarsus with a single golf-club seta, claws present, pulvillus like a fish-tail. Anal opening (Fig. 58d) set well away from the apex of the abdomen, the outer circum-anal pore ring consisting of two to three rows of pores, the inner ring with faint, minute pores.

Other younger stages similar in general characters except for smaller size, and relatively fewer marginal setae and fewer clavate setae on the dorsum, reduced size of the wing-pads, and absence of the tibio-tarsal articulation.

***Diaphorina citri* Kuwayama 1907**

(Fig. 59)

Kuwayama, S. 1907. *Trans. Sapporo nat. Hist. Soc.* 2: 160, pl. III, fig. 16.

Crawford, D. L. 1912. *Rec. Indian Mus.* 7: 424-425, pl. xxiii, figs. N, O, P; pl. xxv, fig. D (*Euphalerus citri* Kuw.)

Crawford, D. L. 1917. *Philipp. J. Sci.* 12: 168. (*Euphalerus citri*).

Fletcher, T. B. 1917. *Proc. Second ent. Meet.*, pp. 215-216.

Fletcher, T. B. 1919. *Proc. Third ent. Meet.*, p. 276.

Hussain, A. M. 1923. *Rep. Proc. Fifth ent. Meet.*, pp. 122-128.

Ramakrishna Ayyar, T. V. 1923. *Rep. Proc. Fifth ent. Meet.*, p. 267.

Crawford, D. L. 1924. *Rec. Indian Mus.* 26: 616.

Ramakrishna Ayyar, T. V. 1924. *Rec. Indian Mus.* 26: 623,

- Hussain, A. M. and Dina Nath, 1927. *Mem. Dep. Agric. India Ent. Ser.* 10(2): 5-27, pls. 1-4, figs. 1-3.
Kuwayama, S. 1931. *Insecta mats* 5: 125.
Kuwayama, S. 1932. *Icon. Ins. Japan*, 1814, fig. 3584.
Shiraki and Takahashi, R. 1933. *Pl. Ind. Publ.* no. 636, Govt. Formosa, 67.
Kuwayama, S. 1943. *Trans. nat. Hist. Soc. Formosa* 33: 506.
Miyatake, Y. 1964. *Contr. Sci. Exped. Kyushu Univ.* 26: 124.

Length of body, in male, 1.7 mm; in female, 2.4 mm
Length of forewings, in male, 2.1 mm; in female, 2.4 mm
Width of head with eyes, 0.55 mm
Width of vertex between eyes, 0.35 mm
Length of antennae, 0.58 mm

Colouration. General colour brown, vertex slightly lighter; antennae black at tip; eyes darker, with black stripe from eye to tip of cone on side (not distinctly visible in living specimen but quite clear in alcoholic material), this stripe varies in colour, usually it is greyish, black only in very dark specimens; the colour of abdomen also varies, it is usually greyish-brown, but in some specimens it is distinctly bluish, while in gravid females, it is distinctly orange; forewings with a spotted macula of brown on the upper margin from a little below tip of clavus to tip of radius, and another on lower margin not quite merged into first, maculae not continuous but composed of smaller scattered spots.

Structure. Body long and slender. Head (**Fig. 59a**) narrower than thorax, descending, very finely pubescent, finely punctate; vertex flat, broader than long, about two and a half times as broad as long, with a large fovea on each side, posterior to centre, posterior margin strongly arcuate, post-ocelli large and lateral, anterior margin almost straight; frons concealed by the genal cones dorsally, but visible ventrally as a large plate; genal cones about 0.12 mm long and slightly smaller than vertex, broad at base, in same plane with vertex, convergent toward and rounded at apex, almost contiguous, finely pubescent and also beset with minute points. Eyes large and recessive. Antennal bases scarcely visible, as in other species. Clypeus large and visible ventrally.

Antennae (**Fig. 59b**) short, not longer than head and pronotum combined, slender, ten-segmented, bearing few setae, imbricate, two basal segments robust and almost subquadrate, 3rd joint longest, 4th, 6th and 8th equal to one another, but each slightly smaller than 3rd, 5th, 7th and 9th equal, but each slightly smaller than 4th, 8th and 9th segments clavate, terminal joint smallest and armed with two unequal, hollow apical spines, four sensoria present on segments 4, 6, 8 and 9.

Thorax very finely pubescent, prominently punctate, scarcely arched. Pronotum rather long, convexly rounded, sides parallel, narrower in middle, broader laterally, with foveal impressions on each side; pleurites typical of genus; prescutum longer than broad, broadest beyond middle, gradually narrowed anteriorly, angulate both laterally and posteriorly; scutum large, broad, broadest beyond middle, about two and one-fourth times as broad as long, almost as long as prescutum, angulate laterally; scutellum narrowly transverse, with prominent antero-lateral angles, posterior margin weakly invaginated medianally.

Legs (**Fig. 59c**) long and slender, coarsely pubescent and also beset with strong points, tibiae longer than femora, each tibia with an apical comb of setae, hind tibiae without basal spur, with 6 to 8 strong, black spines at apex, tarsal joints of each leg of equal length, proximal tarsal joint of hind leg with two black claw-like spines at apex, in between with a pad-like structure, meracanthus large, finger-like.

Forewings (**Fig. 59d**) large and long, subhyaline, rather thickened as in other species, maculate with brown maculae on the upper margin from a little below tip of clavus to tip of radius, and another on lower margin not quite merged into first, maculae not continuous but composed of small scattered spots, attenuate at base, broadest sub-apically, rounded at apex, about two and a third times as long as broad, basal vein shorter than radius, first cubital-long, second marginal cell larger than first, radius long, about twice as long as cubital petiole, pterostigma very narrow, quite long.

Hind wings (**Fig. 59e**) slightly smaller than forewings, membrane uniformly beset with minute points, costal margin armed with a few simple and hooked setae.

Abdomen longer than broad, sparsely pubescent and also beset with points which are thicker and stronger on sternites.

Genitalia. Male genital segment (**Fig. 59f**) smaller than abdomen, rather conspicuous, sparsely pubescent. Anal valve elongate-pyriform or flask-shaped, about 0.38 mm long, attenuate above, anterior margin almost straight, posterior margin broadly rounded, broadest in basal half; parameres (**Fig. 59g**) long, about 0.30 mm long, slender, simple, slightly smaller than anal valve, subacute at tip, ending in a strong tooth at its extremity, mesal and marginal setae longer, a group of simple setae also present in the apical region; hypandrium simple, of usual shape, bearing small scattered setae in the apical region; aedeagus small, outer arm much smaller than basal, basal arm looped and striated, spoon end slightly flattened; sperm pump as figured (**Fig. 59h**).

Female genital segment (**Fig. 59i**) short, small, pubescent; dorsal plate about 0.7 mm long, slightly longer than ventral, wedge-shaped, broad basally and gradually narrowed caudally, with a clear area near base and having an elliptic circum-anal ring, composed of a double row of pores, posterior region armed with minute peg-like setae and also with rows of short strong bristles; ventral plate slightly shorter than dorsal valve, boat-shaped, acutely pointed at apex, with a prominent ventral bulge in middle; ovipositor acutely pointed.

Host plants. Several species of *Citrus*, e.g., *Citrus aurantium* (orange), *C. medica limonium* (lemon), *C. media lunetta* (sweet lime), *C. medica acida* (sour lime), *C. medica* (citron), *C. decumana* (pomelo). This species has been found throughout India, on all the cultivated varieties of *Citrus*. Also recorded on *Murraya koenigii* at Coimbatore (Tamil Nadu), and Pusa (Bihar), and it may be considered as an alternative food plant (Afzal Husain and Dina Nath, 1927). This species has been recorded on *Murraya paniculata* Jack in Japan (Miyatake, 1964).

Distribution. *D. citri* Kuw. is widely distributed throughout the orient (Crawford, 1917). It is known from Formosa, Japan, the Philippine Islands, Moluccas (Amboina), Southern China (Macao), and occurs all over India (Crawford, 1912; Afzal Husain and Dina Nath, 1927). Actual authenticated records are from Pusa (Bihar); Adra

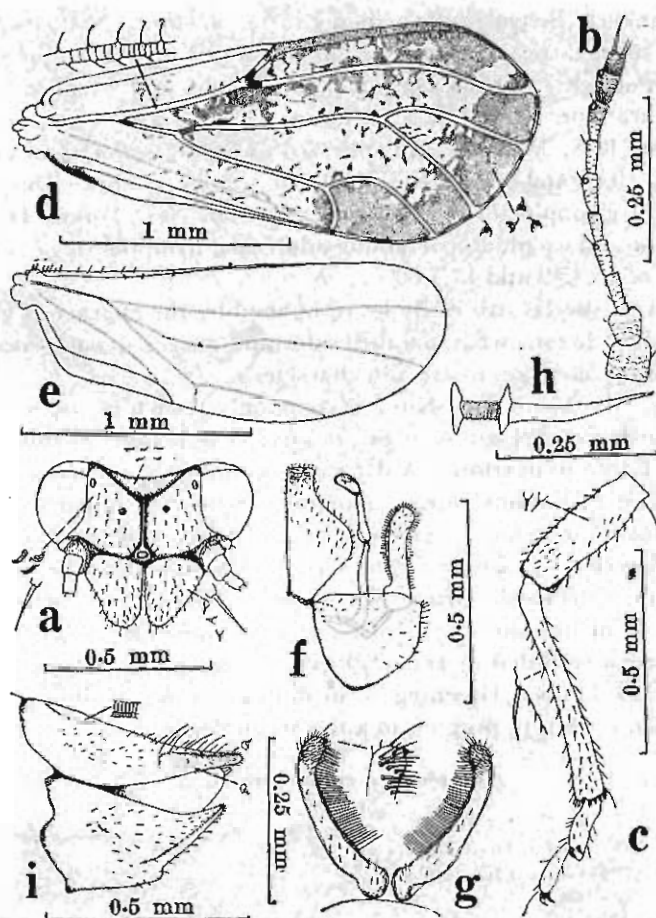


Fig. 59. *Diaphorina citri* Kuwayama—**a**: head, front view; **b**: antenna; **c**: hind leg; **d**: forewing; **e**: hind wing; **f**: male genitalia, lateral view; **g**: parameres, caudal view; **h**: sperm pump; **i**: female genitalia, lateral view.

(Bengal); E. Punjab; Coimbatore (Tamil Nadu); Delhi; Dehra Dun (U.P.); and Pakistan.

Material examined. The collection at I.A.R.I., New Delhi, contains 2 examples of 10.12.08, on orange (C.S.M.), 5 examples of 12.12.08 on orange (D.P.S.), 5 ex. of v. 09. on orange (C.S.M.), 7 ex. of 12.1.09 on orange (D.P.S.), 8 ex. of 17.2.09 on orange (C.S.M.), 1 ex. of 27.6.11 (A.H.), 1 ex. of 11.8.18 on lemon (C.S.M.), 7 ex. of 29.7.15 on *Citrus* (U. Bahadur), 7 ex. of 3.9.15 on lemon leaves (U. Bahadur), and 20 examples, no data. All these specimens are from Pusa, Bihar.

The Zoological Survey of India, Calcutta, collection consists of: Adra, Singbhum Dist., 12.X.09. (No.9731/18) (specimen missing), a tube containing few males and

females, from Bankura (Bengal) collected on 7.iii.53, on *Citrus* (No. 6484/H7), in alcohol, and in another tube, 2 specimens without any data (No. 8822/H7), preserved in alcohol.

The collection at F.R.I., Dehra Dun, includes 4 males and 7 females, of 16.3.59, from New Forest, Dehra Dun (U.P.) (R.N. Mathur), 3 males and 5 females of 17.3.60, also from New Forest (R.N. Mathur) and collected on *Citrus medica*; 3 examples of 9.4.67, 5 examples of 20.10.67 and 2 examples of 20.7.68, from Dehra Dun, on *Citrus* (R.N. Mathur); and 18 examples of 9.7.35, collected from New Forest, Dehra Dun (R.N. Mathur), on *Citrus*. Two phials containing adults and nymphal stages, from New Forest, on *Citrus medica*, of 16.3.59 and 17.3.60.

Comparison. This species can easily be recognised by the characters given in the key. Further its head with somewhat parallel sides and longer genal cones are distinctive features. The wing maculations are also characteristic.

Biological notes. *Diaphorina citri* Kuw. is commonly known as the 'Citrus Psylla', and is of the greatest importance all over the country. The ravages of this insect cause very serious losses to *Citrus* cultivation. A detailed account on its systematic position, distribution, description of various stages, bionomics, economic importance, parasites and predators and control measures, is given by Afzal Husain and Dina Nath (1927). This species is also suspected to cause a serious virus disease known as the 'Greening disease', in *Citrus* orchards. In South Africa, *Trioza erythrae* (Del Guer.), belonging to the sub-family *Triozae*, is incriminated as a vector of the 'Greening' virus of *Citrus*, and this species has not been recorded in India. *Diaphorina citri* Kuw. belongs to the sub-family *Psyllinae*. It is said that the 'Greening' virus disease of *Citrus* is quite prevalent in India and some research work is in progress to assess its virulence.

***Diaphorina communis*, sp. n.**

(Figs. 60, 61)

Mathur, R. N. 1935. *Indian Forest Rec.* 1(2): 40-42.

Beeson, C. F. C. 1941. *Forest Insects*, p. 777.

Length of body, in male, 2.1 mm; in female, 2.4 mm

Length of forewing, in male, 2.5 mm; in female, 2.6 mm

Width of head with eyes, 0.6 mm

Width of vertex between eyes, 0.35 mm

Length of antennae, 0.52 mm

Colouration. (Live and dried specimens). General colour black with greyish-brown tinge and covered with a white mealy-like secretion; head black; genae brownish-black, antennae pale-yellow, basal two joints brownish-black, apical two segments black, tips of joints 4th and 6th black; prescutum with a thin greyish dorsal median line and scutum with a broad dorsal median greyish band; femora black, tibiae and tarsal segments light brown except anterior tibiae having blackish tinge, spines black; abdomen black dorsad and brownish-black ventrad; genitalia brownish black; forewings sub-opaque, densely maculated with smoky black maculae and irregular clear spaces.

Structure, (Fig. 60a). Head somewhat but not greatly declivous, finely punctate;

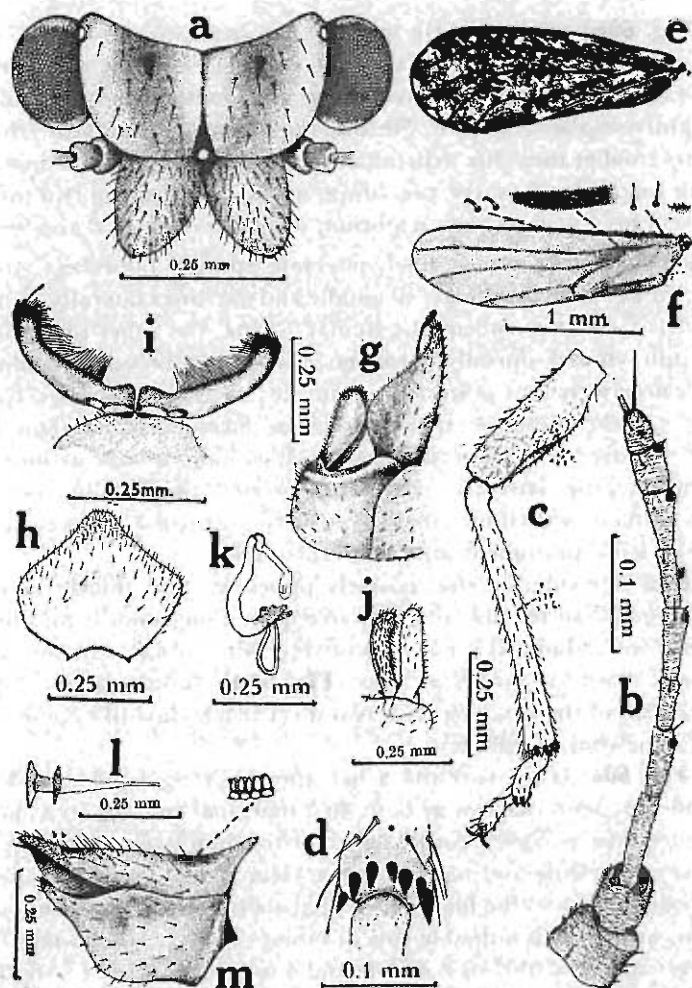


Fig. 60. *Diaphorina communis*, sp. n.—a: dorsal view of head; b: antenna; c: hind leg; d: tibial apical spines on hind leg; e: forewing; (Photo by late Shri K. N. Tandon) f: hind wing; g: lateral view of male genitalia; h: upper surface of anal valve; i: forceps, caudal view; j: forceps, outer and mesal views; k: aedeagus; l: sperm pump; m: female genitalia, lateral view.

including eyes, slightly smaller than thorax. Vertex flat, about twice as broad as long, sparsely pubescent, rather deeply emarginate at the posterior margin, with a large circular fovea on each side near the posterior margin and located slightly inwards from the middle of each half, a shallow depression extending from the fovea towards the anterior. Genae on the same level as the vertex, contiguous near the base, a little longer than wide, about 0.15 mm long and as long as vertex, diverging slightly outwards, bluntly rounded at tip a little more coarsely pubescent than the vertex. Eyes large and recessive,

Antennae (**Fig. 60b**) small, slightly smaller than head including eyes, ten-segmented, bearing a few setae, imbricate, two basal joints robust, 1st broadly transverse, 2nd slightly smaller than 1st, longer than broad, remaining segments slender, 3rd joint longer than others, 4th slightly smaller than 6th, 5th one-third smaller than 6th, 7th and 8th equal but each slightly smaller than 4th, 4th, 6th and 8th clavate, the two terminal joints almost equal in length but wider than the preceding, apical joint having two unequal spines at apex, a small seta present near each sensorium on segments 4, 6, 8 and 9.

Thorax somewhat arched, robust, finely punctate, sparsely pubescent, strongly rugulose. Pronotum flat, viewed dorsally, longer in middle and narrower laterally, convexly rounded, sloping anteriorly, with two subequal, circular foveae, the inner ones smaller than the outer; prescutum viewed dorsally, broader than long, broadest in middle, gradually narrowed both anteriorly and posteriorly, bluntly angled at the sides, distinctly angled submedianally on the posterior margin; scutum large, broader than long, broadest before middle, slightly more than twice as broad as long, almost as long as prescutum, flat dorsally and sloping laterally, slightly depressed medianally, forming a shallow longitudinal channel; scutellum small, narrowly transverse, somewhat vase-shaped, broad anteriorly with prominent antero-lateral angles.

Legs (**Fig. 60c**) of moderate size, coarsely pubescent and thickly beset with minute points, tibiae longer than femora, tibial groove quite long, middle and hind tibiae with three and two stout, subapical setae respectively, hind tibiae without basal spur, with seven stout black tooth-like spines at apex (**Fig. 60d**), tarsal segments of equal length, basal tarsal segment of the hind leg with two short black claw-like spines at apex; meracanthus large, somewhat subtubular.

Forewings (**Fig. 60e**) large, two and a half times as long as wide, widest subapically, narrowly rounded at apex, narrow at base, first marginal cell almost as long as wide but shorter and wider than second, stem R slightly more than twice as long as cubital petiole ($M+Cu$), pterostigma long and narrow; seven clear spaces present at the margin of the wing: 4 spots, one in each of the four cells, 2 spots between Cu_1 and Cu_2 , and 1 spot near clavus; all veins armed with a double row of minute setae. Hind wings (**Fig. 60f**) with the costal margin armed with 7 or 8 simple and 4 to 6 hooked setae. Both wings thickly beset with minute points.

Abdomen longer than broad, sparsely pubescent dorsad and coarse ventrad, sternites also armed with minute points.

Genitalia. Male genitalia (**Fig. 60g**) slightly smaller than abdomen, pubescent; anal valve (**Fig. 60h**) about 0.38 mm long, longer than forceps, rather pyriform in shape when viewed anteriorly, anterior margin almost straight in profile, lateral lobes small, broadly rounded in the basal half; parameres (**Figs. 60i, j**) about 0.25 mm long, in profile, broadly rounded at apex and gradually narrowed down basally, each forcep with a small, strong, black point at apex, just below this point, a cluster of stout setae present, pointing outward, setae on the mesal surface longer and thicker than others and directed downwards, basal region with a strong small projection pointing anteriorly; hypandrium of usual shape, sparsely pubescent; outer arm of aedeagus (**Fig. 60k**) smaller than basal, having a thick spoon end. Sperm pump as figured (**Fig. 60l**).

Female genitalia (**Fig. 60m**) smaller than abdomen, pubescent, both plates broad basally and narrow caudally; anal plate longer than ventral, roundly pointed at apex, apical one-third armed with short, stout peg-like setae, anal opening surrounded by an oval ring of double row of pores and guarded by minute setae; ventral plate with the posterior half bent upward and acutely pointed at apex; ovipositor acutely pointed.

Host plants. Commonly found on *Murraya koenigii* Spreng. and *M. paniculata* (L.) Jack. Rarely on *Citrus* sp.

Type locality. New Forest, Dehra Dun (U.P.).

Types. Described from a long series of specimens. Holotype male; Allotype, female, from the type locality and collected on April 24, 1950 (R.N. Mathur); Paratypes: 20 specimens of September 29, 15 specimens of September 30, 1932, and 15 specimens of May 12, 1933; and 4 males and 7 females of April 24, 1950, all from the type locality (R. N. Mathur); 2 males and 4 females, collected on February 16, 1953, from Dehra Dun (U.P.). Additional material not designated as paratypes are: 6 examples of April 5, 6, 1932; 12 examples of May 12, 1933; 3 males and 4 females from New Forest, Dehra Dun, and collected on April 8, 20 males and 9 females, from the same locality and collected on May 7, 1960, 14 examples collected between January and March 1963 from New Forest and 10 examples from Dehra Dun (R. N. Mathur). The host of all these specimens is *Murraya koenigii*. Three males and 4 females, from New Forest, Dehra Dun and collected on April 8, 1960, and 20 males and 9 females, collected on May 7, 1960, recorded from *Murraya paniculata* (L.) Jack. A good collection of adults of April 5, 1964, collected on *Murraya koenigii*, Hardwar-Rishikesh Road (M.G. Ramdas Menon), was examined by the author at the Indian Agricultural Research Institute, New Delhi. Some adults and nymphal stages collected on April 10, April 15, 1948 from Dehra Dun (U.P.) and April 8 and May 5, 1960 from New Forest, Dehra Dun, on *Murraya koenigii*, (R. N. Mathur), were preserved in alcohol. Some adults collected on *M. paniculata*, on May 5, 1960, from New Forest, Dehra Dun (R. N. Mathur), and preserved in alcohol. All the type material and preserved specimens, together with the slides, deposited at F.R.I., Dehra Dun.

Comparison. *Diaphorina communis*, sp. n. is clearly differentiated from other species of *Diaphorina* by its black colouration, densely maculated wings, shape of head and genal cones, and genital characters. It matches closely with *D. dunensis*, sp. n. and *D. truncata* Crawf. in colouration, but differs greatly from them in shape of head, genae and genital armature.

Biological notes. This species is quite common on *Murraya koenigii*, wherever it grows. Its bionomics and economic importance are given in detail by Mathur (1935), and the nymphal stages are described below.

Nymphal stages

Fifth stage. (**Fig. 61a**). Length 1.59 mm. Broadly oval; the wing pads large and well developed, projecting from the side of the body, the humeral angle produced cephalad, reaching slightly below the anterior margin of the eyes; eyes prominent. Dorsum strongly sclerotic throughout, having numerous plates as illustrated: head with a pair

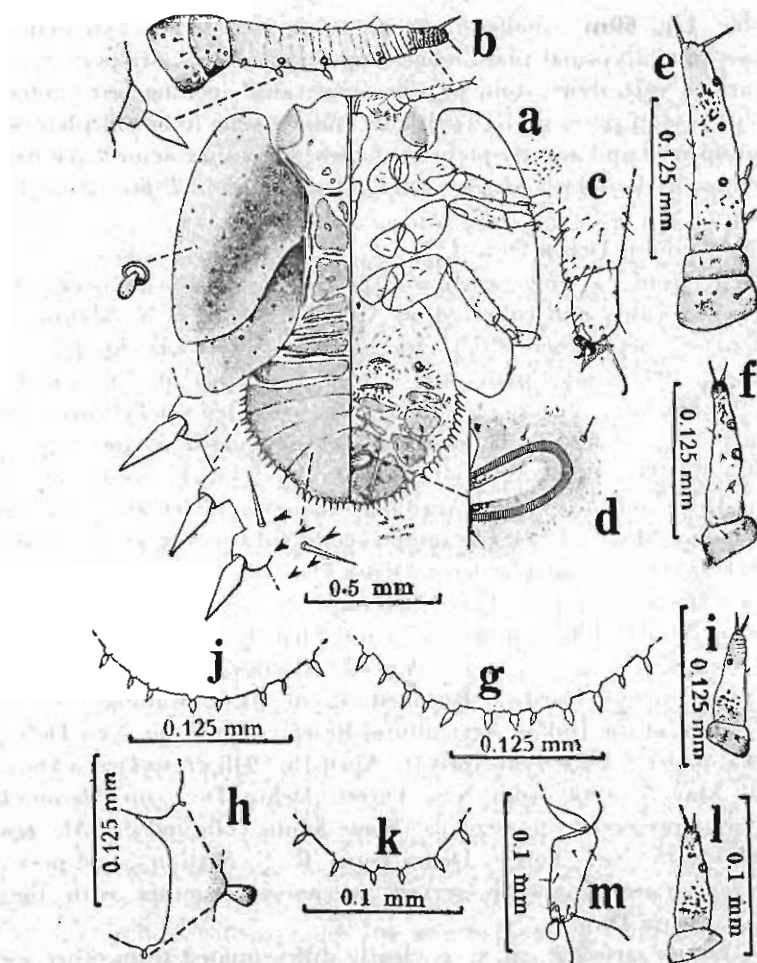


Fig. 61. *Diaphorina communis*, sp. n.—a: fifth stage nymph; b: antenna; c: part of leg; d: circum-anal ring; e: antenna, fourth stage nymph; f, g, h: antenna, abdominal margin, wing-pads of third stage nymph; i, j: antenna and abdominal margin of second stage nymph, k, l, m: abdominal margin, antenna and leg of first stage nymph.

of large plates separated from the thorax by two pairs of narrow sclerites, each thoracic segment with a pair of large and several small plates, the large plates of both head and thorax separated mesally by a narrow strip. Abdomen with four pairs of mesally separated narrow plates and a large posterior plate indicating traces of segmentation, thin sclerites also present intersegmentally between some of the anterior tergal plates. Entire margin of abdomen armed with a continuous series of 45 to 50 lanceolate setae. Derm thickly beset with minute points and sparsely with clavate setae on head and thorax and simple setae on abdomen.

Ventral side membranous throughout except for a small plate at the base of each antenna, one near the eye, the anal area with two lateral areas, a small area about each spiracle and four pairs of small submedian areas. All these sclerotic areas are beset with minute points and the posterior portion of anal area with fringed processes. Derm of wing-pads with minute points and of abdomen with simple ring-based setae of various length. Antennae (**Fig. 61b**) borne at the margin of the head, quite large, about 0.34 mm long and armed with a few simple setae, three-segmented; the first two basal segments distinct, quite short; third segment longest, not differentiated into segments, bearing three lanceolate setae, the proximal seta smaller than the other two, with four sensoria and two unequal, thick terminal spines. Legs (**Fig. 61c**) well developed, with a few simple setae, without trochanter, with tibio-tarsal articulation well defined, tarsus with a single golf-club seta, claws present, pulvillus large, fish tail-like.

Anal opening (**Fig. 61d**) situated well inside from the apex of the body, the outer circumanal pore ring consisting of a single row of slit-like pores, the inner ring with an irregular row of small faint pores, and guarded by one anterior, one lateral and one posterior pairs of setae.

Fourth stage. Length 0.98 mm. Resembles the fifth stage, except in having smaller wing pads, less number of thoracic plates, antennae (**Fig. 61e**) with three sensoria and two lanceolate setae, tibio-tarsal articulation absent, slight reduction in the number of lanceolate setae situated along the margin of apical plate of the abdomen, with one large and one small seta alternating.

Third stage. (**Figs. 61f, g, h**). Length 0.62 mm. Like the fourth stage but with two-segmented antennae having only two sensoria and one lanceolate seta on the second segment, marginal lanceolate setae on abdomen fewer; each wing pad with a single clavate seta.

Second stage. (**Figs. 61i, j**). Length 0.45 mm. With two-segmented antennae and having one sensorium, without lanceolate seta; marginal setae on abdomen still fewer; wing-pads with a single lanceolate seta on each.

First stage. (**Figs. 61k, l, m**). Length 0.33 mm. Antennae two-segmented, with one sensorium; dorsal plates markedly defined; each wing-pad represented by a lanceolate seta; with two golf-club setae on each of the middle and hind legs and a single seta on each of the forelegs; pulvilli like flat rounded lobes; anus nearer the apex.

***Diaphorina dunensis*, sp. n.**

(**Fig. 62**)

Length of body, in male, 2.16 mm; in female, 2.35 mm
Length of forewings, in male, 2.7 mm; in female, 2.7 mm
Width of head with eyes, 0.62 mm
Width of vertex between eyes, 0.35 mm
Length of antennae, 0.52 mm

Colouration. General colour fuscous; head dark-brown; genae light brown; antennae pale brown, two basal segments brown and two apical segments black; presepium anteriorly, two broad, longitudinal bands on scutum, scutellum and parapteron black;

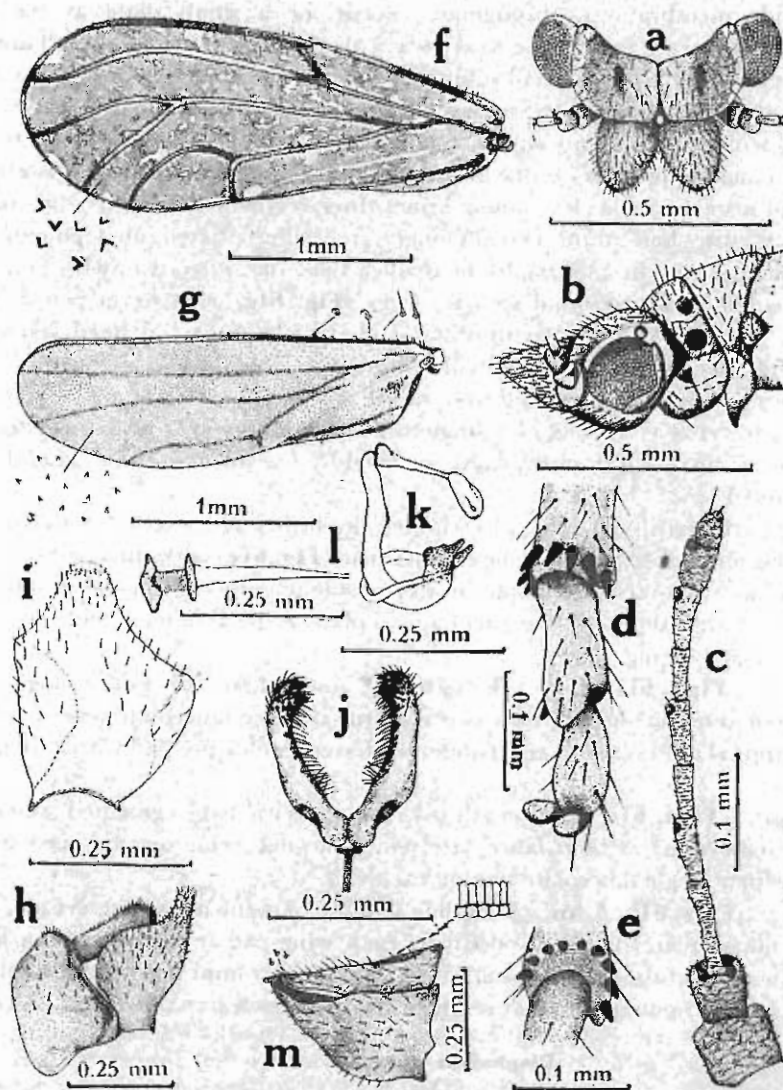


Fig. 62. *Diaphorina dunensis*, sp. n.—a: front view of head; b: lateral view of head and part of thorax; c: antenna; d, e: part of hind leg, showing arrangement and number of apical spines on tibia; f: forewing; g: hind wing; h: lateral view of male genitalia; i: outer surface of anal valve; j: caudal view of forceps; k: lateral view of aedeagus; l: sperm pump; m: lateral view of female genitalia.

femora fuscous, tibiae and tarsal joints pale brown, spines black; abdomen fuscous dorsad and bluish-green or greyish-brown ventrad; genitalia fuscous; forewings sub-opaque, maculated entirely with fuscous patches intermixed with small irregular clear spaces, seven clear spots present along the margin.

Structure. Body long. Head (**Figs. 62a, b**) somewhat but not greatly deflexed, sparsely pubescent, finely punctate; including eyes, slightly narrower than thorax, vertex flat, about thrice as broad as the length of the median suture, deeply emarginate at the posterior margin, with a distinct circular fovea on each side of the median suture, near the posterior margin and near the middle of each half, with a shallow linear depression extending anteriorly from each; genal cones on same level as the vertex, contiguous near the base, slightly longer than wide, about 0.18 mm long and slightly longer than vertex, slightly divergent outward, rounded at tip, a little more coarsely pubescent than the vertex. Eyes of medium size, slightly recessive.

Antennae (**Fig. 62c**) ten-segmented, smaller than the head including eyes, imbricate, bearing a few setae, two basal joints robust, 1st broadly transverse, 2nd subquadrate, remaining segments thicker, 3rd segment longer than others, segments 4, 6 and 8 equal and each one-third smaller than 3rd, segments 5 and 7 equal and each smaller than 4th, two apical segments slightly wider than the preceding, with two unequal spines at apex, four sensoria present on segments 4, 6, 8 and 9.

Thorax (**Fig. 62b**) somewhat arched, robust, finely punctate, coarsely pubescent. Pronotum flat, viewed dorsally, longer in middle and narrower laterally, with two sub-equal foveae on each lateral side, the inner ones smaller than the outer; prescutum viewed dorsally, broader than long, about twice as broad as long, broadest before middle, bluntly angled at the sides and distinctly angled submedianally on the posterior margin; scutum broad and convex, gradually sloping laterally and posteriorly, about twice as broad as long, broadest in middle, with a shallow longitudinal channel, angled at the sides and on the posterior margin; scutellum small and transverse, about twice as broad as long.

Legs (**Figs. 62d, e**) of medium size, coarsely pubescent; tibiae longer than femora, tibial groove quite long; hind tibiae without basal spur and with 7 to 9 short, stout, black spines on the apical margin, basal segment of hind tarsi with two claw-like spines at apex, tarsal segments of equal length; meracanthus large, triangular.

Forewings (**Fig. 62f**) large, about two and a half times as long as wide, widest sub-apically, rounded at apex, narrow at base, pterostigma long and narrow, stem R about twice as long as basal vein ($R+M+Cu$) and thrice as long as cubital petiole ($M+Cu$), cubital petiole about one-third smaller than basal vein, first marginal cell almost as long as wide, but shorter and wider than the second, veins armed with a double row of minute setae. Hind wings (**Fig. 62g**) with the costal margin armed with 7 to 8 simple and 4 to 6 hooked setae. Both wings thickly beset with minute points.

Abdomen longer than broad, sparsely pubescent, setae longer on sternites.

Genitalia. Male genital segment (**Fig. 62b**) slightly smaller than abdomen, sparsely pubescent, anal valve (**Fig. 62i**) pyriform, longer than parameres, about 0.38 mm long, anterior margin almost straight in profile, lateral lobes large and broadly rounded;

parameres (**Fig. 62j**) about 0.26 mm long, swollen and slightly broader at apex and then narrowed down in the basal region when viewed laterally, each paramere with a small, strong, acute black tooth at apex, surrounded by a cluster of long and stout setae, marginal setae slightly longer and directed downward; hypandrium of usual shape and simple; outer arm of aedeagus (**Fig. 62k**) smaller than basal with a thick spoon end. Sperm pump as figured (**Fig. 62l**).

Female genital segment (**Fig. 62m**) smaller than abdomen, sparsely pubescent. Dorsal plate longer than ventral, narrowly rounded at apex, apical region closely beset with minute peg-like setae, anal opening surrounded by an oval ring of double row of pores and guarded by small setae; ventral plate strongly cocked up from posterior half and acutely pointed at apex.

Host plant. Commonly found on *Ehretia acuminata* R. Br.

Type locality. New Forest, Dehra Dun (U.P.).

Types. Holotype, male; Allotype, female; collected on August 5, 1957, from the type locality (R. N. Mathur); Paratypes: 12 males and 11 females, also from the type locality and the same date of collection (R. N. Mathur). Additional paratypes specimens collected from the type locality, on August 5, 1957, are: 19 males and 10 females; also 6 males and 4 females collected on July 16, 1960, and 2 males and 2 females collected on July 18, 1960, from New Forest, Dehra Dun (U.P.) (R. N. Mathur). To study the characters in detail few adults from the type locality were dissected and their parts were mounted on slides. Adults of both sexes were also preserved in alcohol, collected on July 26, 1966, from New Forest, Dehra Dun. All this material, together with the types, are deposited at F.R.I., Dehra Dun.

Comparison. This new species is described from a long series of both sexes, and is easily distinguishable by its colouration, wing pattern, shape of genal cones and genital armature. In colouration, it resembles *D. communis* present on *Murraya koenigii*, but differs greatly from it, in shape of genal cones, number of black apical spines in hind tibiae, and genital structures.

***Diaphorina enderleini* Klimaszewski 1890**

(Fig. 63)

Lethierry, M. 1890. *Proc. Asiat. Soc. Beng.*, p. 165 (*D. guttula*).

Enderlein, G. 1910. *Hemiptera*, 8, *Psyllidae*, in Sjostedt Y. *Zoologische Kilimandjaro-Meru Expedition*, 2, Stockholm, pp. 137-144. (*Gonanoplicus guttulatus*).

Aulmann, G. 1913. *Psyllidarum catalogus*, Berlin, p. 23.

Crawford, D. L. 1917. *Philipp. J. Sci.* 12: 168.

Crawford, 1924. *Rec. Indian Mus.* 26: 616-617.

Ramakrishna Ayyar, T. V. 1924. *Rec. Indian Mus.* 26: 623.

Klimaszewski, S. M. 1964. *Ann. Zool. Warsz.* 22(3): 59. (*D. enderleini*, nom. nov.)

Length of body, in female, 1.88 mm

Length of forewings, in female, 2.00 mm

Width of head with eyes, 0.55 mm

Width of vertex between eyes, 0.35 mm

Length of antenna, 0.51 mm

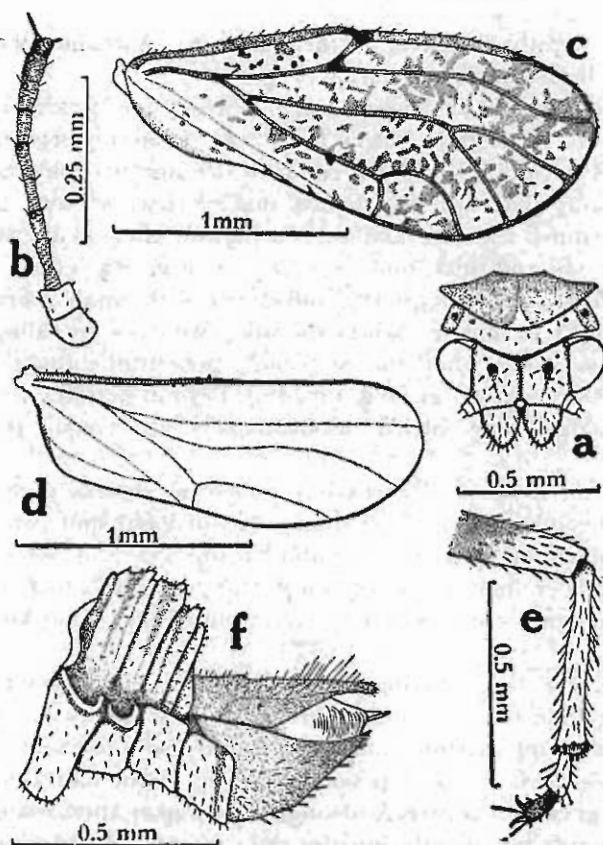


Fig. 63. *Diaphorina enderleini* Klimaszewski—**a**: dorsal view of head and part of thorax; **b**: antenna; **c**: forewing; **d**: hind wing; **e**: hind leg; **f**: lateral view of female genitalia and abdomen.

Colouration. General colour dark-brown to fuscous, prothorax and head and tibiae of lighter colour, genae black along the margin and ventrally, apical tarsi dark-brown, venter of abdomen light brown, apical segments and apices of segments 4, 6 and 7 of antennae black, apical half of forewings with more or less uniformly distributed maculae, while the basal half more nearly clear and hyaline, with less number of brown spots.

Structure. Body small and slender. Head (**Fig. 63a**) almost as broad as thorax, moderately deflexed, sparsely pubescent, punctate, vertex a little more than twice as broad as the length of median suture, disc nearly flat, with a small, circular fovea in each half near the middle and posterior to centre, and also with a distinct, minute puncture posterior to each fovea, shallow depression extending forward from each fovea towards the anterior margin but not attaining it, posterior margin moderately emarginate, anterior ocellus visible from above; genal cones on the same level as the vertex, somewhat porrect, contiguous at or near the base, about as wide as long, almost as long as vertex, diverging outward, subconical at tips, conspicuously pubescent, with hairs slightly longer than that

of vertex. Eyes slightly recessive, of medium size. Antennal sockets lateral, and located somewhat below the lower margin of eyes.

Antennae (**Fig. 63b**) small, ten-segmented, bearing few setae, two basal segments robust, subquadrate, 1st slightly longer than 2nd, remaining segments imbricate, 3rd segment longest, 4th, 5th, 7th and 8th equal to one another and each slightly smaller than 6th, 6th smaller than 3rd, 9th slightly smaller than 8th and slightly longer than apical segment, terminal segment smallest, bearing two unequal apical spines, two apical segments rather broad and thick, four sensoria present on segments 4, 6, 8 and 9.

Thorax (**Fig. 63a**) somewhat arched, pubescent with small hairs, finely punctate. Prothorax flat, longer in middle than at the sides, with two foveal impressions on each side, the innermost smaller than the outermost; prescutum broader than long, about one and a half times as broad as long, broadest beyond middle, acutely angled at the sides, posterior margin also angled submedianally (Specimen pinned through the scutum).

Legs (**Fig. 63e**) of medium size, coarsely pubescent, femora shorter than tibiae, all tibiae with apical comb of setae, hind tibiae without basal spur, with about five black spines on the margin at apex, three visible on one side and two on the other, basal tarsal segments smaller than apical segments, hind basal tarsal segment with two black claw-like spines at apex, coxae robust, meracanthus strong, of medium size and acutely conical.

Forewings (**Fig. 63c**) large, having numerous and scattered maculations in the apical half, slightly more than twice as long as broad, broadest subapically, narrowly rounded at apex, pterostigma long, narrow, pubescent, radius about one and a half times as long as basal vein ($R+M+C$), cubital petiole ($M+Cu$) about half as long as basal vein, R_1 nearly as long as cubital petiole, R_s strongly flexed near apex, marginal cells unequal, first cell much shorter but slightly broader than second. Hind wings (**Fig. 63d**) large and slightly smaller than forewings, membrane uniformly beset with minute points, costal vein armed with few simple and hooked setae, veins quite prominent.

Abdomen (**Fig. 63f**) longer than broad, sparsely pubescent with prominent hairs.

Genitalia. Female genital segment (**Fig. 63f**) slightly smaller than abdomen, sparsely pubescent, both plates broad basally and gradually narrowed posteriorly, dorsal plate longer than ventral, attenuate and roundly pointed apically, weakly flexed ventrally near apex, setae longer in middle, caudal region with smaller setae; circum-anal region large, somewhat oval in shape; ventral plate with apex acutely pointed, but broad and bluntly rounded when seen from the ventral side; the apical part of the dorsal valvula projecting laterally as broad membranous plate and rounded posteriorly; ovipositor slightly exerted and acutely pointed.

Distribution. Poona, Bombay, September 8, 1911 (T.B. Fletcher).

Material examined. In the collection of the Zoological Survey of India, Calcutta, the writer examined 4 specimens, all females, collected from Poona, December 1889 (R. Wroughton) (Reg.No.1563/12), and determined by Lethierry. At the Indian Agricultural Research Institute, New Delhi, the author has also examined three specimens in poor condition, determined by Rahman in 1926. These specimens are also labelled

by D.L. Crawford as *Diaphorina citri* Kuw. Due to their poor condition, it has not been possible to determine them correctly. They bear the data: Poona, Bombay, September 8, 1911 (T.B.F.). However, from the date of collection, i.e., September 8, 1911, all these specimens obviously belong to *D. enderleini* Klimaszewski.

Comparison. Lethierry (1890) described this species from the specimens collected in December, 1889, from Poona, Bombay (R.C. Wroughton). His description is very brief, pertaining mostly to colouration of both sexes. It appears that the four females present at the Zoological Survey of India, Calcutta, belong to this original lot. Crawford (1924) observed some variation in the colour pattern of the forewing in the specimens collected on September 8, 1911, from Poona (T.B. Fletcher). These specimens show considerable variation in the amount of maculation and the wings are more extensively whitish and hyaline with numerous brown spots, whereas the Wroughton's specimens are mostly dark and opaque with numerous white spots. The description given above is based on a single female specimen received on loan from the Smithsonian Institution, United States National Museum, Washington, through the courtesy of Dr (Miss) Russell. This specimen is labelled as Poona, Bombay, September 8, 1911, (T.B.F.), (Pusa coll.) (1943 coll. D. L. Crawford), and determined as *Diaphorina guttulata* Leth. There are two specimens in the Smithsonian Institution. Since the author has seen both the lots, he agrees with Crawford's views and the species is redescribed. Klimaszewski (1964) has proposed a new name, *D. enderleini*, for *guttulata* Leth.

D. enderleini Klimaszewski, resembles closely with *D. communis*, *D. dunensis*, and *D. truncata* Crawf., in colouration, but differs from them in shape of wing, shape of vertex and genal cones, and female genitalia. No male specimen is present in the collections in India.

***Diaphorina gymnosporiae*, sp. n.**

(Figs. 64, 65)

- Length of body, in male, 1.86 mm; in female, 1.97 mm
- Length of forewings, in male, 1.92 mm; in female, 2.00 mm
- Width of head with eyes, 0.52 mm
- Width of vertex between eyes, 0.32 mm
- Length of antennae, 0.45 mm

Colouration. (Specimens preserved in alcohol). General colour chrome-orange; head orange, ocelli reddish, eyes pinkish-red, antennae pale-yellow, except two basal, two apical segments and apex of eighth segment which are black; genae smoky ventrally; anterior border and lateral sides of prothorax, a pair of broad, anterior bands on pre-scutum, two pairs of longitudinal, submedian bands on scutum, scutellum posteriorly, metanotum posteriorly and lateral sclerites smoky black; anterior and middle legs, posterior legs with femur, about one-fourth of tibia basally, and apical tarsal segment fuscous, while the three-fourths of tibia and basal tarsal segment of hind leg pale-yellow. Forewings semi-hyaline and partly maculated, the maculae forming rather large areas all along the veins, with hyaline areas extending in all cells (Fig. 64f), junction of veins R, R₁ and R_s, base of cubital petiole and base of media dark-black. Abdominal tergites

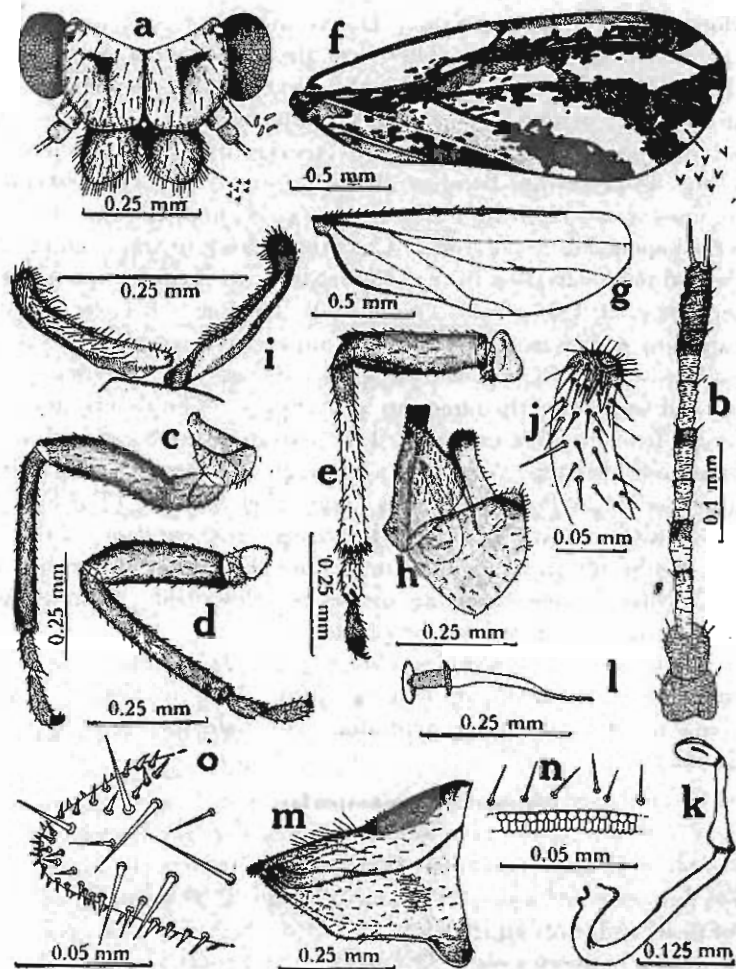


Fig. 64. *Diaphorina gymnosporiae*, sp. n.—a. head, dorsal view; b. antenna; c, d, e. fore, middle and hind legs; f. forewing; g. hind wing; h. male genital segment, lateral view; i. forceps, lateral and mesal views; j. apical portion of forcep, mesal view; k. aedeagus; l. sperm pump; m. female genital segment, lateral view; n. portion of anal ring; o. caudal end of dorsal plate, dorsal view.

smoky brown. Female genital segment smoky brown; anal valve of male genitalia smoky brown.

In dried specimens, general colour light orange with smoky brown tinge, eyes grey. The specimens collected from New Delhi are slightly darker, with darker maculations.

Structure. Body long and narrow. Head (Fig. 64a) scarcely deflexed, including the eyes, narrower than thorax, pubescent and also beset with minute points (seen under high magnification); vertex about twice as wide as the length of the median line, rather

deeply emarginate at the posterior margin, with two foveal impressions on each side, posterior to centre and in the middle of each half, anterior foveae larger than the posterior foveae, a shallow linear depression extending forward from the anterior fovea and nearly reaching to the anterior border of vertex; genal cones on the same level as vertex, directed forward, separate, subconical, longer than broad, about 0.12 mm long and slightly smaller than the vertex, divergent and curving outwards, a little more coarsely pubescent than the vertex and also armed with minute points. Eyes large, recessive and somewhat reniform. Antennal sockets lateral.

Antennae (**Fig. 64b**) thick, ten-segmented, bearing few setae, two basal segments robust, 1st broadly transverse, 2nd longer than broad, remaining segments imbricate, 3rd segment narrower and slightly longer than others, segments 4, 6 and 8 slightly thicker and each almost equal in length, 5th segment small, 7th slightly longer than 5th but smaller than 4th, 8th slightly thicker apically, segment 9 broad and about as long as 5th, apical segment slightly smaller than the penultimate segment and provided with two long spines at apex, four sensoria present on segments 4, 6, 8 and 9.

Thorax moderately arched, robust, punctate, sparsely pubescent, the setae almost as long as those on the head, thickly beset with minute points arranged somewhat in rows. Pronotum flat, weakly arched, viewed dorsally, slightly longer in middle than at the sides, with two large foveal impressions of equal size on each side; prescutum partly concealed anteriorly under pronotum, broader than long, broadest beyond middle, about one and a half times as broad as long, gradually narrowed anteriorly, acutely angled laterally, weakly angular on each side of the posterior margin; scutum very broad and arched, about twice as broad as long, broadest in middle, slightly longer than prescutum, angled laterally; scutellum small and narrowly transverse, somewhat rectangular, antero-lateral angles prominent.

Legs (**Figs. 64c, d, e**) of medium size, pubescent with strong setae, fore and middle femora slightly arched, tibiae longer than femora and each bearing apical comb of setae, hind tibiae with five long and slender black spines on the apical margin, basal tarsal segment of all legs smaller than apical, basal tarsal segment of hind leg with two stout, black spines at apex, meracanthus of medium size, acutely conical.

Forewings (**Fig. 64f**) large, broad subapically, about two and a half times as long as wide at the widest part, rounded at apex, narrow at base, stem R about one and one-fourth times as long as basal vein ($R+M+C$), cubital petiole ($M+Cu$) about one-third shorter than basal vein, pterostigma long and narrow, R_2 quite long and flexed downward near apex, first marginal cell as long as wide and distinctly shorter in length and wider than second, membrane thickly beset with minute points, veins armed with two rows of setae (seen under high magnification). Hind wings (**Fig. 64g**) also quite large and thickly beset with minute points, costal margin armed with a few simple and hooked setae, veins quite distinct.

Abdomen long and slender, finely and sparsely pubescent.

Genitalia. Male genital segment (**Fig. 64h**) smaller than abdomen, sparsely pubescent, anal valve (proctiger) longer than forceps, about 0.28 mm long, in profile, anterior margin weakly convex in middle, invaginated both basally and apically, apical region attenuated,

posterior margin broadly convex in middle, converging both basally and apically; forceps (parameres) (**Fig. 64i**) about 0.22 mm long, with subparallel sides, viewed from behind, each forcep bowed towards each other, bluntly pointed at tip and thickly beset with setae (**Fig. 64j**) apically, mesal surface armed with thick setae pointing downward, marginal setae slightly longer; hypandrium simple, of usual shape, and sparsely beset with small setae; aedeagus (**Fig. 64k**) moderately long, elbowed, outer arm smaller than basal, with thick spoon end; sperm pump as figured (**Fig. 64l**).

Female genital segment (**Fig. 64m**) smaller than abdomen. ventral plate a little shorter than dorsal, dorsal plate sparsely pubescent with small, simple setae, narrowly and roundly pointed caudally, caudal region armed with small, peg-like setae (**Fig. 64o**), anal aperture large, somewhat elliptical, and surrounded by a double row of pores (**Fig. 64n**), hairs longer in middle, ventral plate beset with small setae and acutely pointed apically; ovipositor acutely pointed.

Host plant. Collected on *Gymnosporia spinosa* (Forsk.) Fiori (= *Gymnosporia montana* Benth.).

Type locality. Mandwa plantation, E. Asir range, Ninnar Forest division (M.P.).

Types. Described from a small series of specimens of adults, collected with nymphal stages, on *Gymnosporia spinosa*. Holotype male; Allotype female, both from the type locality and collected on March 16, 1959 (R.N. Mathur); Paratypes: 1 male and 2 females, from the same locality and date, 8 males and 2 females from Charkhera, Singhaji range, M.P., collected on January 12, 1956 (F.R.I. Project). Additional specimens examined are from New Delhi, 7 males and 13 females, collected (date not recorded) by M.G. Ramdas Menon. Host also unknown. All types, some nymphal stages and few adults preserved in alcohol, and some slides deposited at F.R.I., Dehra Dun. The New Delhi specimens are deposited at I.A.R.I., New Delhi.

Comparison. *Diaphorina gymnosporiae*, sp.n. is distinguishable by its characteristic maculated bands in the forewings, shape of vertex, separate and divergent genal cones, antennae and genital characters. From *D. bikanerensis*, sp.n., it is separated by the different pattern of bands in forewings and shape of genal cones.

Biological notes. The adults and nymphs are commonly found infesting young buds and fresh leaves of *Gymnosporia spinosa* in Madhya Pradesh. The nymphs remain in congregation on young buds and exude small globules of honey dew profusely, which are covered with waxy powder. Mature nymphs crawl on the under surface of leaves and shed their last skin there. The description of the nymphal stages is given below.

Nymphal stages

Colour pale chrome orange with smoky plates as indicated (**Fig. 65**). Eyes pinkish-red, antennae smoky black at apex.

Fifth stage. (**Fig. 65a**). Length 1.35 mm; of psylline form, broadly oval. Head slightly narrower than the abdomen. Wing-pads projecting beyond the general margin of the body and produced cephalad at the humeral angle and bluntly rounded. Head well marked and separated from the thorax. Eyes small. Derm membranous, except for the sclerotic areas of the head, wing pads, the posterior two-thirds of the abdomen,

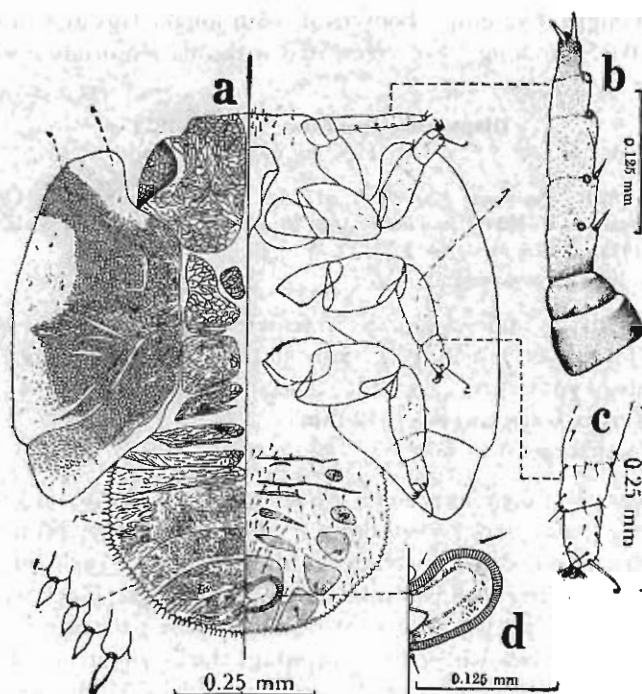


Fig. 65. *Diuphorina gymnosporiae*, sp. n.—a: fifth stage nymph; b: antenna; c: part of leg; d: circum-anal ring.

and the smaller areas of thorax and abdomen as shown in the figure. Entire margin of the caudal plate beset with a continuous series of slender, spear-shaped setae borne upon distinct prominences. Dorsum with the derm vermiculate and with punctate appearance and beset with minute, scattered setae.

Ventral side membranous, except for small areas near the spiracles, small abdominal strips and an anal plate. These sclerotic areas are thickly beset with minute points. Derm sparsely beset with simple ring-based setae intersegmentally in the abdomen. Antennae (Fig. 65b) located ventrally, short, about 0.25 mm long, three-segmented, two basal segments broad and transverse; third segment long with imperfect segmentations, with four sensoria and two terminal spines. Legs (Fig. 65c) relatively short, with few setae, without trochanters, with the tibio-tarsal articulation well-defined, tarsus with a single golf-club seta; claws present; pulvillus small, fish-tail like. Anal opening (Fig. 65d) set well in from the apex of the abdomen, surrounded by the outer circum-anal pore ring consisting of a single row of slit-like pores and the inner ring of indistinguishable pores.

Fourth stage. Length 0.90 mm. Resembles the fifth stage, except in having smaller wing pads, antennae three-segmented, 0.15 mm long and with three sensoria, and tibio-tarsal articulation absent.

Second stage. Length 0.42 mm. Body oval, with longer legs and broader abdominal plates; antennae 0.07 mm long, two segmented with one sensorium; with few marginal setae on abdomen.

***Diaphorina truncata* Crawford 1924**
(Figs. 66, 67)

Crawford, D. L. 1924. *Rec. Indian Mus.* 26(6): 617, figs. 1, 1a (India; Southern China).

Ramakrishna Ayyar, T. V. 1924. *Rec. Indian Mus.* 26: 624 (Walayar forests, Malabar).

Mathur, R. N. 1935. *Indian Forest Rec.* 1(2): 42.

Benson, C. F. C. 1941. *Forest Insects*, p. 777.

Length of body, in male, 2.25 mm; in female, 2.67 mm

Length of forewings, in male, 2.15 mm; in female, 2.70 mm

Width of head with eyes, 0.64 mm

Width of vertex between eyes, 0.42 mm

Length of antennae, 0.47 mm

Colouration. General colour chocolate brown to black or fuscous; head dark-brown with black foveae; genae dark-brown dorsally, black ventrally; pronotum dark-brown with a pale median line and with two lateral black foveae on each side; prescutum and scutum dark-brown, scutum with two submedian, longitudinal black stripes on each side of the middle; femora of all legs fuscous, tibiae and tarsi pale brown; abdomen black, venter with greenish or yellowish tinge; forewings dark-brown to black, mottled with numerous maculae distributed all over the surface, with a large hyaline area near the apex of anterior basal cell, a round area near apex of cell R_s and another large area at the apex of cell Cu.

Structure. Body not large, slender. Head (Fig. 66a) not deflexed, somewhat horizontal, including eyes slightly shorter than widest part of thorax; vertex about two times wider than the length in the middle, surface rough, slightly swollen in middle, posterior margin deeply emarginate, with a small circular fovea in each half near the middle, posterior to the centre, sparsely pubescent, antero-lateral margins produced forward as small angles; anterior ocellus visible from above; genae about 0.12 mm long and smaller than and on same level as vertex, directed forward, closely approximate for about half their length, slightly wider than long, divergent apically, truncate at tip, coarsely and conspicuously pubescent, with setae a little longer than on the vertex. Eyes of medium size, slightly recessive. Antennal sockets lateral.

Antennae (Fig. 66b) small, ten-segmented, bearing few setae, two basal segments robust, 1st and 2nd subquadrate, 2nd smaller than 1st, remaining segments slender, imbricate, 3rd and 4th longest but equal, 5th and 7th small but equal, 6th slightly smaller than 4th, 8th slightly smaller than 6th, 9th segment thick and slightly longer than 7th, terminal segment smallest, bearing two unequal spines at apex, four sensoria present on segments 4, 6, 8 and 9.

Thorax somewhat arched, finely and sparsely pubescent, thickly covered with minute points, finely punctate. Prothorax slightly narrower in middle, anterior margin roundly notched medianally, with a ridge-like border on either side of the notch, two lateral

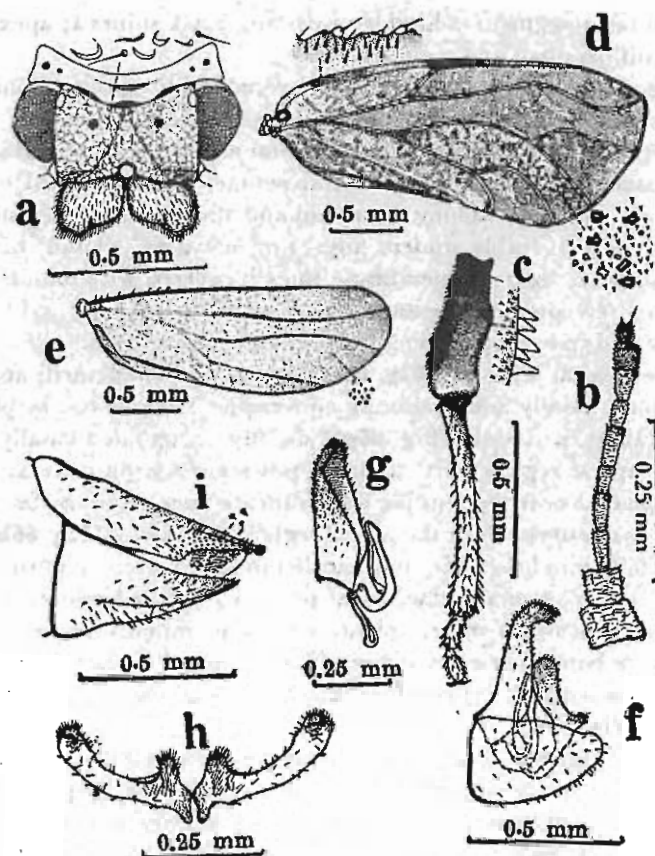


Fig. 66. *Diaphorina truncata* Crawl.—a: dorsal view of head and prothorax; b: antenna; c: hind leg; d: forewing; e: hind wing; f: lateral view of male genitalia; g: anal valve and aedeagus; h: caudal view of forceps; i: lateral view of female genitalia.

circular foveae present on each side, the inner ones smaller than the outer; prescutum twice as broad as long, widest in middle, conspicuously angled submedianally on the posterior margin; scutum large and longer than prescutum, about twice as broad as long, broadest before middle, with a shallow longitudinal channel medianally, disc swollen in small, longitudinal patches having impressed areas in between; scutellum small, transverse, bowl-shaped, about twice as broad as long, with prominent antero-lateral angles; mesepisternum large and produced forward.

Legs (Fig. 66c) of medium size, coarsely pubescent and also armed with minute points, which are thicker on femora, femora shorter than tibiae, all tibiae with apical comb of setae, fore and middle tibiae with a weak basal spur, but hind tibiae possess a prominent, acutely pointed, black basal spur, and armed with six stout, black spines on the margin at apex (2 on the outer, 2 on the inner and 2 on the lateral sides), tarsi of all legs of

equal length, basal tarsal segment of hind leg with two black spines at apex, tibial groove quite long, meracanthus small and conical.

Forewings (**Fig. 66d**) opaque, membrane covered with minute points and thick, irregular specks, slightly more than twice as long as wide at the widest part, with an angular apex, narrow at base, pterostigma short and narrow, stem R slightly longer than cubital petiole, basal vein shorter than cubital petiole, vein Rs flexed before reaching apex, first marginal cell nearly as long as second and also as wide as second, veins armed with two rows of setae, visible under high magnification. Hind wings (**Fig. 66e**) transparent, venation as figured, membrane thickly covered with minute points, costal margin beset with a few simple setae and hooked setae.

Abdomen finely and sparsely pubescent, setae longer on sternites.

Genitalia. Male genital segment (**Fig. 66f**) smaller than abdomen, anal valve about 0.45 mm long, broad basally and gradually converging towards tip, in profile, anterior margin almost straight in middle (**Fig. 66g**), slightly invaginated basally and convexly rounded apically, apical region bent caudally, posterior margin convexly rounded and then deeply invaginated near top, ending in a truncate apex, outer surface beset sparsely with small setae, setae numerous in the apical region; parameres (**Fig. 66h**) smaller than anal valve, about 0.25 mm long, sides sub-parallel in lateral view, slightly broad apically and beset with a cluster of small setae, basal portion produced posteriorly into a small thick lobe, bearing a brush of setae, apical end black, roundly pointed and margined at top, outer surface beset sparsely with small setae, mesal surface armed with a bunch of small setae just below apex; hypandrium simple, of usual shape; outer arm of aedeagus small and slender (**Fig. 66g**).

Female genitalia (**Fig. 66i**) smaller than abdomen, both plates broad basally and narrow caudally; dorsal plate slightly longer than ventral, roundly pointed at tip, armed with short setae which become more numerous and heavier posteriorly and arranged in a band; ventral plate sparsely beset with simple setae, slightly invaginated ventrally near base and acutely pointed apically.

Host plant. On young twigs and fresh leaves of *Strychnos nux-vomica* Linn.

Distribution. Crawford (1924) has mentioned India (Walayar Forests), Malabar May 1921 (Ramakrishna coll.); Southern China (Macao) (F. Muir).

Material examined. Few specimens of both sexes, in poor condition, from Thogarapalli near Krishnagiri, Salem District, April 18, 1963 (B.V. David); a large collection of adults and nymphs, received preserved in alcohol, collected from Medical College campus, Calicut, Kerala, between February 29 and March 3, 1968 (K.J. Joseph); from this collection, 9 males and 11 females were mounted on cards. All this material has been deposited at F.R.I., Dehra Dun.

Comparison. *D. truncata* Crawf. resembles closely *D. communis*, *D. dunensis* and *D. enderleini* Klimasz. in colouration, but is easily recognised by the angular apical margin of forewing and the conspicuously truncate genal cones. Crawford (1924) has mentioned that this is a very distinct species and apparently more closely related to a South African species.

Biological notes. It is reported that this species is commonly found in S. India, wherever

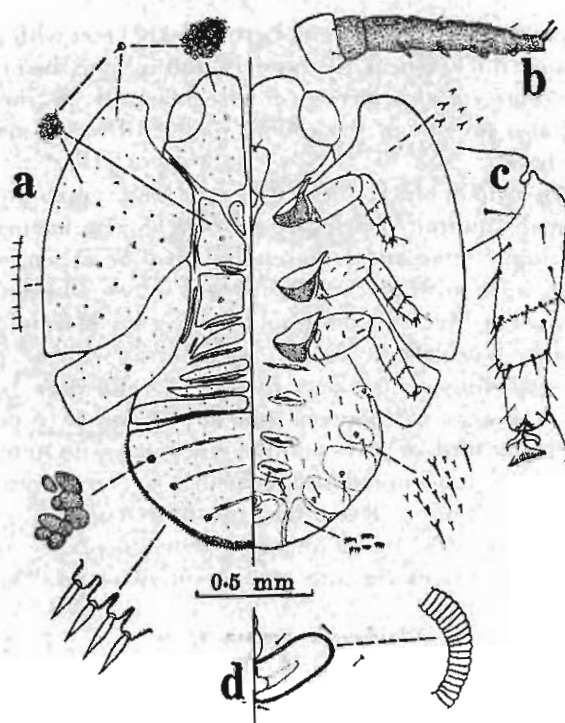


Fig. 67. *Diaphorina truncata* Crawf.—a: fifth stage nymph; b: antenna; c: part of leg; d: circum-anal pore ring.

Strychnos nux-vomica grows. Mature nymphs are pale yellow with light smoky tinge, antennae black and eyes pinkish red in colour, and are described below.

Nymphal stages

Fifth stage. (Fig. 67a). Length 2.05 mm. Body quite large, broadly oval, the continuity is broken near the head and the base of abdomen; wing-pads large, the humeral angle extending forward up to the anterior margin of eyes, head smaller than the width of abdomen; dorsum with the derm mostly sclerotic, consisting of large head plates, a number of small thoracic plates, wing-pads, four pairs of small, transverse, strip-like anterior abdominal plates and a large single posterior plate in the abdomen. Derm vermiculate, punctate, punctures strong and thick near the borders, thickly beset with minute points and sparsely with minute, scattered, simple setae. Head and wing-pads armed with small, simple setae along the margin, posterior abdominal plate black near the border and armed with a marginal row of lanceolate setae.

Ventral side for the most part membranous, except for a small plate beneath each antenna, four pairs of submedian, transverse, strip-like plates, six pairs of lateral plates enclosing the spiracles, and an irregular caudal plate bearing the anus and the

circum-anal ring of pores in the abdomen. Derm thickly beset with minute points which becoming stronger and thicker near the borders, and sparsely beset with simple setae of various length, these setae are also present intersegmentally in the abdomen, minute comb-like structures also present in the caudal plate. Rostrum armed with two pairs of simple setae near base.

Antennae (**Fig. 67b**) small, black, about 0.36 mm long, apparently three-segmented, basal two segments small and transverse, third segment longest, having traces of segmentation, bearing a few simple setae and four sensoria, two basal sensoria guarded by two thick lanceolate setae, apex with two small, unequal spines. Legs (**Fig. 67c**) small and thick, having a few scattered setae, femora not reaching the margin of the body, without trochanters, tibio-tarsal articulation distinct, each tarsus with a prominent golf-club seta, claws present, empodium with a large fish-tail like pulvillus. Anal opening (**Fig. 67d**) well in front of the apex of abdomen and surrounded by a double ring of pores, the outer ring consisting of slit-like pores and the inner ring with minute, faint oval pores, both rings are medianally interrupted and guarded by two anterior pairs of setae.

Fourth stage. Length 1.2 mm. Resembles the fifth stage, except in being smaller in size, with smaller wing-pads, less number of thoracic plates, antennae apparently three-segmented, with three sensoria and absence of tibio-tarsal articulation.

Diaphorina venata, sp. n.

(**Fig. 68**)

Length of body, in female, 2.35 mm

Length of forewings, in female, 2.58 mm

Width of head with eyes, 0.81 mm

Width of vertex between eyes, 0.48 mm

Length of antennae, (missing in specimens).

Colouration. General colour dark-brown with blackish tinge, head and genae dark-brown, prothorax with a light black median patch, prescutum with two light black, longitudinal bands anteriorly, scutum with two pairs of submedian, longitudinal bands, legs dark-brown, hind tibiae of lighter colour, forewings with numerous and scattered dark-brown or blackish maculae intermixed with hyaline areas, maculae less in the basal area, venter of abdomen pale brown.

Structure. Body small but robust. Head (**Fig. 68a**) somewhat deflexed, almost as broad as thorax, sparsely pubescent; vertex about thrice as broad as the length of median suture, deeply emarginate at the posterior margin, with a distinct circular fovea on each side, posterior to centre and near the middle of each half, disc swollen on either side of median line, front ocellus visible from above; genae on the same level as the vertex, broader than long, about 0.12 mm long, shorter than vertex, contiguous at or near the base, slightly divergent at apex, apices bluntly rounded, a little more pubescent than the vertex; frons covered by the genae and visible ventrally as a large plate. Eyes large and recessive. Clypeus large, thick and tubular. Antennae missing.

Thorax (**Fig. 68a**) robust, arched, sparsely pubescent, finely punctate. Pronotum

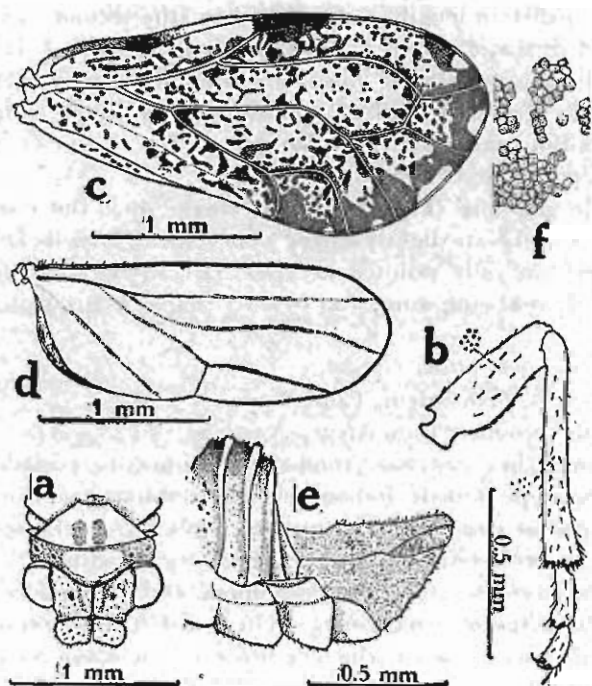


Fig. 68. *Diaphorina venata*, sp. n.—a: head and part of thorax; b: hind leg; c: forewing; d: hind wing; e: female genitalia and part of hind abdominal segments, lateral aspect; f: sculpture pattern of forewing, highly magnified.

arched, viewed dorsally, longer in middle and narrower laterally, anterior margin convexly rounded, with two foveal impressions on each lateral side; prescutum viewed dorsally, about twice as broad as long, broadest slightly before middle, distinctly angled submedianally at the posterior margin; scutum large, longer than prescutum, broader than long, about twice as broad as long, broadest before middle, anterior margin concavely rounded, disc shallowly depressed in middle when viewed dorsally, gradually sloping laterally, acutely angled at the sides; scutellum small, narrowly transverse, about twice as broad as long, anterior margin with prominent antero-lateral angles.

Legs (Fig. 68b) of medium size, thick, pubescent and also beset with thick minute points, femora shorter than tibiae, all tibiae with apical comb of setae, hind tibiae without basal spur, with about nine short, stout black spines on the margin at apex, tarsal segments of nearly equal length, hind basal tarsus with two black claw-like spines at apex, tibial groove long; meracanthus strong, thick and conical.

Forewings (Fig. 68c) small, almost twice as long as broad, widest in apical half and roundly angulate at apex, narrow at base, radius slightly longer than basal vein, cubital petiole shorter than basal vein; pterostigma small, narrow, pubescent; R_s flexed near apex, a prominent cross vein present joining the flexed portion of R_s with fork M_{1+2} ,

first marginal cell smaller in length and width than the second, second marginal cell somewhat trapezoid in shape; maculae (**Fig. 68f**) numerous and scattered inter-mixed with hyaline areas, basal area with less maculae, five hyaline spots present along the apical margin. Hind wings (**Fig. 68d**) slightly smaller than forewings, costal vein armed with some simple and hooked setae, venation as figured.

Abdomen small, sparsely pubescent.

Genitalia. Female genitalia (**Fig. 68e**) large, longer than the rest of the abdomen, sparsely pubescent; dorsal plate slightly longer than ventral, broader at base and gradually narrowed posteriorly, roundly pointed at apex, circum-anal region large, occupying nearly the basal half, anal ring somewhat oval in shape; ventral plate acutely pointed at apex.

Host plant. On *Santalum album* (sandal).

Type locality. Aiyur, North Salem, Tamil Nadu.

Types. Two female specimens from Aiyur, North Salem, 25.iv.31 (F.R.I. Sandal Insect Survey), one specimen in very poor condition. No males available for description. **Holotype** female; **Paratype**: female, in poor condition; data same, from the type locality.

Comparison. *Diaphorina venata*, sp.n. is easily recognised from the other Indian species, in possessing an extra cross vein, joining the radial sector with M_{1+2} . This cross vein is present on both the forewings and in both specimens, and is, therefore, not an aberration. It also differs in the shape of genal cones. These differences prompted the author to consider it under a distinct genus for which he proposed the name *Neodiaphorina*, however, the consensus of opinion in consultation with Dr Tuthill, Dr Russell and others, has been that it would be better to retain it tentatively under *Diaphorina*.

Genus **EUPHALERUS** Schwarz 1904

Euphalerus

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Type species. *Euphalerus nidifex* Schwarz, 1904 (original designation) from Key West, Florida.

The distinctive characters outlined by Schwarz (1904) and Crawford (1914) are expanded with my notes, as below.

Body robust, surface rugulose or punctate. Head nearly or quite as broad as thorax, vertical to subvertical; vertex flat, often rugulose, broader than long, sides straight between eyes, then converging to front, truncate at front margin; antero lateral angles prominent, posterior ocelli scarcely elevated and anterior ocellus visible from above. Genal cones large, broad, flat, usually quadrate, rounded at apex, more or less divergent, not depressed below level of vertex, separated therefrom by a slightly impressed line. Eyes large,