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Chaetotaxy of first instar caterpillar of the Common Pierrot *Castalius rosimon* (Fabricius) (Papilionoidea: Lycaenidae: Polyommatinae)

Manbeer Kaur [1], Avtar Kaur Sidhu [2] & H.S. Rose [3]

[1] BAM Khalsa College, Garhshanker, Disrict, Hoshiarpur, Punjab 144527, India
[2] High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan, Himachal Pradesh 173211, India
[3] SUS College of Research & Technology, Mohali, Punjab 140306, India
[1] kaur.manbeer@rediffmail.com (corresponding author),
[2] avtarkaur2000@gmail.com, [3] profhsrose@gmail.com

According to Bridges (1988), the genus *Castalius* Hübner comprises three species, viz.: *austini* Heron, 1894, *sostris* Fruhstorfer, 1916, and *rosimon* Fabricius, 1775. *Castalius rosimon* commonly called Common Pierrot occurs in South-east Asia. The life history and immature biology of *Castalius rosimon* is studied in detail by Sidhu et al. (2009) but no details on the chaetotaxy of the larva is given. Chaetotaxy not only plays a key role in the identification of different insect species during their larval stages, but is also significantly important in understanding phylogenetic relationships amongst different taxa of varying ranks. Ballmer & Pratt (1988) have stated chaetotaxy to be the most reliable and primary tool for identifying the larvae of Lepidoptera. In view of this, the chaetotaxy of the first instar larva of *C. rosimon* is attempted for the first time. Since it is the type species of the genus, it will also help in improving the diagnosis of the genus

Material and Methods: In order to examine the chaetotaxy, the first larvae reared on the leaves of its natural host plant, *Zizipus oenoplia* Mill. (Rhamnaceae) in Himachal Pradesh in the laboratory culture, were first killed by dipping in boiling hot water before preserving them in nine part 75% ethyl alcohol and one part glycerine (Stehr 1987). For examination of the larval chaetotaxy, the larvae were degraded and brought down to water. The head of each larva was detached from the body under a zoom stereo-binocular. In order to make skin preparation, the body of the larva was given a midventral longitudinal cut with a sharp blade. Both the body and the head of the larva were put in 10% KOH solution for a period of about 6-8 hours (first instar) at room temperature for maceration and proper clarity. The traces of KOH were removed by placing the material in 1% glacial acetic acid. After dehydration, the chaetotaxy of head was examined by putting the same in glycerine in a cavity slide. The skin preparation of the body of each larva was stained in eosine solution, followed by dehydration and clearing in xylene before mounting it permanently on the slide in canada balsam. The tactile setae on the head and the body of first instar have been drawn with the help of a graph eye piece fixed in a stereoscopic microscope binocular. The proprioceptors or micro setae have been located quite carefully with stereoscopic microscope (at 40x20x or 100x20x). Except the head capsule and A_{10}, the setal maps showing relative position and size of the setae, and other structures between dorsal and ventral meson from left side have been for all the remaining segments, i.e., T_1, T_2 (T_3 is similar to T_2), A_1 (A_2, A7, A_8 are similar to A_1), A_3 (A_4 to A_6 are similar to A_3) and A_9 (Hinton 1946; Stehr 1987). The chaetotaxy of the head capsule and

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A_{10} have been drawn similar to their shape. For naming different setae and pores, the nomenclature proposed by Heinrich (1916), Hinton (1946) Clark & Dickson (1956), Stehr (1987), Ballmer & Pratt (1989, 1992), and Ballmer & Wright (2008) has been followed in the present study.

Observations: First Instar Larva (Fig. 1): Cephalic chaetotaxy (Figs. 1 and 2): Cranium longer than broad, less sclerotized; epicranial notch extremely deep, giving the head somewhat bilobed appearance, frontoclypeus as long as wide; lateral adfrontal suture very long, more than double the length of epicranial suture; ecdysial line obscure; stemmatal area bears six stemmata; 1 to 5 placed equidistantly, arranged in a semicircle. Stemma 6 caudad to stemma 3, widely spaced from stemma 5. Head capsule characterized by 15 setae and 2 pores.

Frons graced with seta F_1 and pore F_a; F_1 slightly posterad and mesad to C_1, slightly longer than the latter; F_a prominent, posterad and mesad to F_1; single seta C_1 makes up clypeus group, present near epicondyle. Adfrontal group trisetose, represented by setae AF_1, AF_2 and AF_3; AF_2 beset near middle of lateral adfrontal suture; AF_1 anterad to AF_2 infront of stemma 3; AF_3 mesad to A_1, cephalad to AF_2; all adfrontal setae nearly equal in length.

Anterodorsal area furnished with three setae. A_1, A_2, A_3 and pore A_a; A_1 anteromesad to stemma 4; A_3 lies infront of stemma 4; A_1 mesad to stemma 1; Aa situated close to A_3, infront of stemma 2. Posteriodorsal group composed of single seta P_2, lies laterad to epicranial notch, as long as A_1. Stemmatal group represented by setae S_1, S_2 and S_3 on stemmatal area; S_1 beset within the stemmatal semicircle, caudoventrad to stemma 3; S_2 caudad to stemma 1; S_3 present behind stemma 6. Substemmatal area furnished with setae SS_1, SS_2 and SS_3; SS_1 lies at base of mandible; SS_2 behind stemma 5; SS_3 ventrad to SS_2; $SS_2 > SS_3 = SS_1$ lengthwise.

Thoracic chaetotaxy: Tactile setae mounted on cone-like chalazae; V_1 seta of ventral group and proprioceptors raised on pinacula.

T_1 (Fig. 3): Prothoracic shield elongated with anterior margin curved, posterior straighter; each half graced with four setae and one lenticle. XD group composed of XD_1 and XD_2 setae; XD_1 situated on the shield at its middle, towards middorsum; XD_2 posterolaterad to XD_1, near posterior margin of the shield, as long as XD_1. Dorsal group formed of setae D_1 and D_2 besides lenticle DL; seta D_1 lies at anterior margin of the shield, cephalad to XD_1; D_2 lies below XD_2, less than 1/4 of the length of XD_2, as long as D_1. Two fringe setae (FS) situated at membranous area, anterolaterad to the shield. Subdorsal group bisetose, with seta SD_1 ventral to D_2, below posterior margin of the shield, slightly shorter than XD_2; SD_2 anterodorsad to SD_1, equal to half of the length of the latter. Lateral group exhibited by setae L_1 and L_2 along with lenticle SPSL, beset above spiracle; L_1 ventrad to SD_2; L_2 posterolaterad to L_1, anterodorsad to SPSL, equal to 1/2 of the length of L_1; SPSL located cephalodorsad to spiracle, below SD_1. Subventral group constituted by setae SV_1 and SV_2, lying below spiracle; SV_1 ventrad to L_2; SV_2 anterodorsad to SV_1, shorter than the latter. Ventral group consisted of single seta V_1 graced at postcoxal position, near median ventral line. Proprioceptor seta MXD_1 lies posterodorsad to XD_2; microsetae MV_2 and MV_3 situated before coxa of the leg; MV_3 ventrad to MV_2.

T_2 and T_3 (Figs. 4 and 5): Dorsal group composed of setae D_1, D_2 and lenticle DL; D_1 very long, lies toward dorsal mesal line; D_2 posterolaterad to D_1, 2/3 of the length of the latter; DL present anterolaterad to D_2. Subdorsal group exhibited by setae SD_1, SD_2, SD_3, and SD_4; SD_1 located very close and laterocaudad to DL, as long as D1, SD_3 dorsad to DL and cephalad to D_2, 2/3 of the length of SD_1; SD_2 anterolaterad to SD_1, very short, less than 1/5 of the length of SD_1; SD_4 caudoventrad to SD_2, as long as the latter. Setae L_1, L_2, L_3, L_4, L_5 and L_6 represent lateral group; L_4, L_1, L_2 and L_3 lie in a horizontal line respectively in lateral area, L_1 longest, remaining three setae nearly equal in length; L_5 situated anterolaterad but close to L_4, equal to less than 1/2 of the length of L_2; L_6 ventrad to L_5, as long as the latter; on T_3, setae L_5 and L_6 absent. Subventral group trisetose, formed of setae SV_1, SV_2 and SV_3 lying above coxa of the leg; SV_2 anterad to SV_1, SV_3 ventrad to SV_2, nearly equal to 1/2 of the length of the latter; in T_3 seta SV_3 wanting. V_1 seta of ventral group beset near median ventral line. Microscopic seta MD_1 situated cephalad to DL; MSD_1 and MSD_2 in front of seta SD_4, MSD_2 ventrad to MSD_1; before coxa of the leg, lies proprioceptors MV_1, MV_2 and MV_3, MV_1 cephalad to SV_2, MV_2 posterolaterad to MV_2, lies equidistantly between MV_1 and MV_3, the latter ventrad to MV_1.

Abdominal chaetotaxy: Tactile setae beset on cone-like chalazae; microsetae and V_1 seta of ventral group lie on pinacula.

A_1 and A_2 (Figs. 8 and 9): Setae D_1 and D_2 besides lenticle DL make up dorsal group: D_1 lies closer to dorsal meson; D_2 located below D_1, slightly shorter than the latter; DL laterad to D_2. Subdorsal group comprised of seta SD_3 and a pore SDP; SD_3 anterodorsad to DL, very short in size; SDP posterolaterad to DL, lies above spiracle; on A_2, SDP larger in size, in subdorsal group also present a lenticle SPSL, lying immediately dorsad to spiracle. Lateral group possesses setae L_1, L_2, L_3 and lenticle SBSL; the latter lie very close and anteroventrad to spiracle, SBSL absent in A_2; L_1, L_2 and L_3 beset below but widely apart

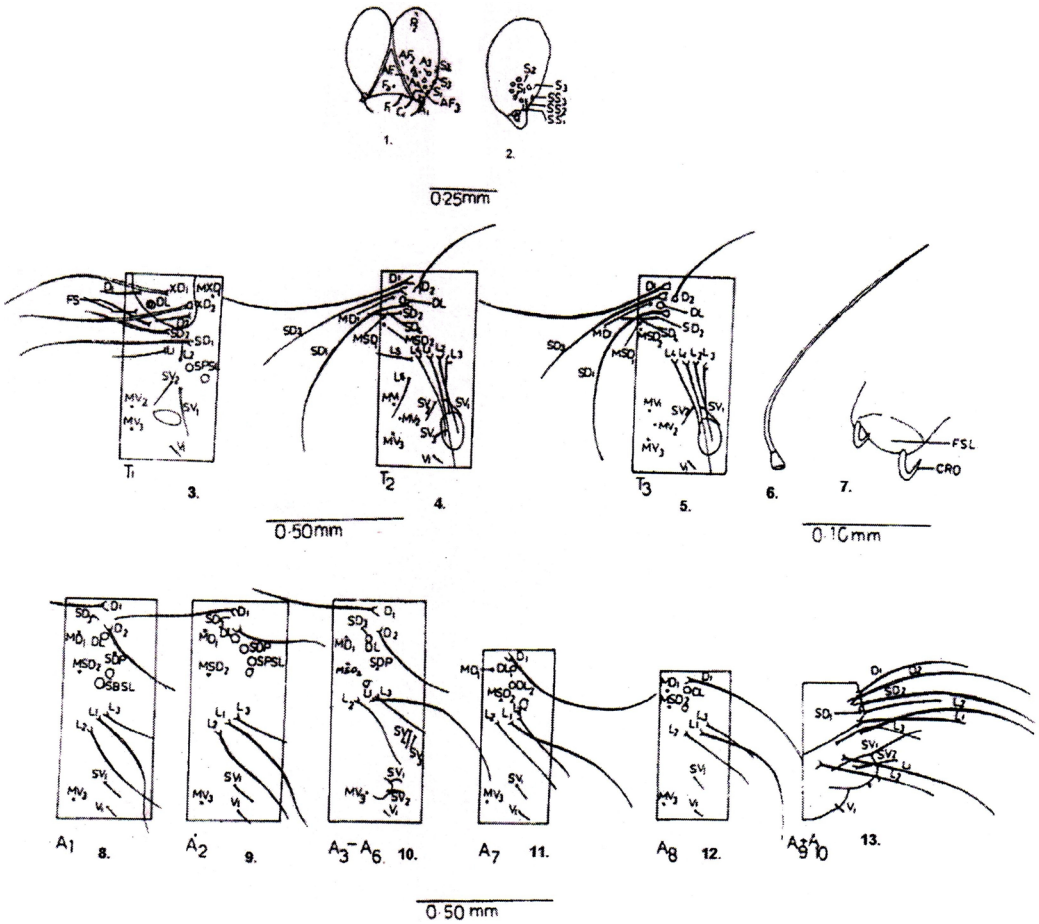

Figure 1. First instar larva of *Castalius rosimon* (Fabricius)
1 - Chaetotaxy of head (frontal view); 2 - Chaetotaxy of head (lateral view); 3 - Chaetotaxy map of T_1; 4 - Chaetotaxy map of T_2; 5 - Chaetotaxy map of T_3; 6 - Tactile seta of dorsal group; 7 - Proleg of A_3; 8 - Chaetotaxy map of A_1; 9 - Chaetotaxy map of A_2; 10 - Chaetotaxy map of A_3 to A_6; 11 - Chaetotaxy map of A_7; 12 - Chaetotaxy map of A_8; 13 - Chaetotaxy map of A_9 + A_{10}

from SBSL, L_1 directly ventrad to SBSL, L_2 anteroventrad to L_1, L_3 posterodorsad to L_1; L_1> L_2> L_3 lengthwise. Subventral group unisetose, with seta SV_1 lying well below L_1, very short in size. Ventral group consists of seta V_1, located towards midventral line. Microscopic seta MD_1 situated cephalad to DL; MSD_z anterad to spiracle; MV_3 anteroventrad to SV_1.

A_3 and A_6 (Figs. 7 and 10): D_1 seta lies dorsad to D_2, near middorsal line, longer than D_2; lenticle DL situated anterad to D_2. Subdorsal group composed of seta SD_3 and pore SDP; SD_3 anterodorsad to DL, very short in size; SDP posterolaterad to DL. Lateral group setae L_1, L_2 and L_3 present below spiracle, closely approximated, beset in a horizontal line, L_2 taking the anterior most position, L_1, in the middle and L_3 the most caudad seta of the group; L_1> L_2> L_3 lengthwise. Subventral group represented by setae SV_1, SV_2, SV_3 and SV_4; SV_3 and SV_4 liecaudoventrad to lateral group; SV_3 caudad to SV_4, slightly longer than the latter; setae SV_1 and SV_2 situated on dorsal area of proleg. V_1 seta of ventral group present near median ventral line. Microseta MD_1 lies anterad to DL; MSD_2 cephalad to spiracle; MV_3 precoxal in position. Proleg graced with uniserial, uniordial crochets; fleshy spatulate lobe present in centre, enflanked by one crochet on either side.

A_7 (Fig. 11): Dorsal group exhibited by one seta D_1 and two lenticles, DL_1 and DL_2; D_1 longest seta of the segment, lies close to dorsal meson; DL_1 caudolaterad to D_1; DL_2 ventrad to DL_1. Lateral group trisetose, represented by setae L_1, L_2 and L_3; L_3 beset below spiracle; L_2 anteroventrad to L_3; L_2 cephalad to L_1; L_1 longest seta of the group, somewhat shorter than D_1; L_2 and L_3 equal in length, 2/3 of the length of L_1, SV_1, seta of subventral group situated well below L_1 on subventral area, very short in size. Ventral group composed of seta V_1, situated ventrad to SV_1, towards ventral mesal line. Proprioceptor seta MD_1 lies cephalad to DL, MSD_2 anterad to spiracle; MV_3 anteroventrad to SV_1.

A_8 (Fig. 12): Seta D_1 and lenticle DL make up dorsal

group; D_1 very long, present near median dorsal line; DL laterad to D_1. Lateral group represented by setae L_1, L_2 and L_3 lying below spiracle; L_2 directly ventrad to spiracle; L_1 caudad to L_2; L_3 posterodorsad to L_1; L_1 as long as D_1, L_2 nearly 1/2 the length of L_1, L_3 shorter than L_2. Microseta MD_1 present anterad to DL; MSD_2 lies infront of spiracle; MV_3 cephaloventrad to SV_1.

A_9 (Fig. 13): Lateral group trisetose, composed of setae L_1, L_2 and L_3, arranged closely on lateral area; L_2 the most anterior seta of the group; L_1 caudad to L_2; L_3 dorsad to L_1; $L_1 > L_2 > L_3$ lengthwise.

A_{10} (Fig. 13): Anal shield ill-defined, caudal margin rounded furnished with closely placed four setae; D_1 dorsal most seta on shield; D_2 anterodorsad to D_1; SD_2 ventrad to D_2, as long as D_2; SD_1 caudad to SD_2, equal to 1/2 the length of the latter. Lateral group setae L_1 and L_2 placed contiguous with lateral group setae of 9th segment; L_1, much longer and dorsad to L_2. Anal leg beset with setae SV_1 and SV_2 of sub ventral group. Seta V_1 of ventral group situated below the proleg, closer to ventral mesal line.

Discussion and significance of the present study: Hinton (1946) has recognized two functional types of setae, i.e., microscopic or proprioceptor setae which are relatively much smaller and located near the anterior margins of the body segments and the posterior dorsal area of the head, where different body parts make contact, and the tactile setae which are quite long and widely distributed on the body of the caterpillars. The tactile setae have earlier been differentiated as primary, subprimary and secondary (Fracker 1914). The former i.e., primary setae represent an archetypal lepidopteran setal pattern, whose number and position is constant in the first instar larvae. The subprimary setae mostly appearing in the second instar also occur at fixed locations (Stehr 1987), except the family Lycaenidae, in which they may occur in the first instar as well (Hinton, 1946; Ballmer & Pratt 1988). In butterflies, it is a prerequisite to examine the first instar caterpillar of any species for authentic identification. Lawrence & Downey (1966) reported MD group setae (they termed it as V group) on the head capsule and three lateral setae on T_2 and T_3 segments of *Everes comynta* Godart of subfamily Polyommatinae. Sidhu & Rose (2004) observed MD group of setae on head capsule, four lateral group setae on T_2 and three lateral group setae on T_3 in the species *Freyria putli* (Kollar) of subfamily Polyommatinae. Duarte et al. (2005) recorded MD group of setae on the head capsule of *Calycopis caulonia* (Hewitson) of subfamily Theclinae and three lateral setae on T_2 and T_3 segments of the said species. Ballmer & Wright (2008) observed MD setae on head capsule and three lateral setae on T_2 and T_3 segments of *Ahmetia achaja* (Fruhstorfer) of subfamily Theclinae. Durate & Robbins (2009) reported MD group of setae (they termed it as CD group) on head capsule and three lateral setae on second and third thoracic segments in species *Calycopis bellera* (Hewitson) and *C. janeirica* (Felder) of subfamily Theclinae. The absence of CD group on head capsule, presence of five lateral setae on T_2 and presence of four lateral setae on T_3 in the presently studied species appears to constitute the diagnostic characters of *Castatlius rosimon*. The present study will help in field identification of species at larval stage and in better understanding of taxonomic classification of the group.

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