CLADISTIC ANALYSIS OF THE PLUSINE SPECIES (LEPIDOPTERA: NOCTUIDAE:PLUSIINAE) FROM PAKISTAN

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Abstract

The cladistic analysis of twenty two species of twelve genera of the sub-family Plusiinae is attempted by using their apomorphic characters from Pakistan. A cladogram is constructed and included taxa are discussed by their sister group and outgroup relationships on the basis of synapomorphies and autapomorphies.

Introduction

The representative of plusine moths are quadrified and are serious pest of cash crops. Hampson (1892; 1896) has described sub-family Plusiinae with three genera *Plusia, Abrostola* and *Plusiodonta*. Recently Hashmi and Tashfeen (1992) gave a check list "Lepidoptera of Pakistan" and listed eleven species of the above genera. The taxonomic, rivisonal and pheromone studies had done by various authors but in Pakistan a little work on above aspects is done by Ahmad and Kamaluddin (1980, 1987, 1988) and Kamaluddin and Ahmad (1982) on the genus *Spodoptera* and *Mythimna*.

Kamaluddin, *et al.* (1999) attempted the cladistic analysis of Sphingid genera of Pakistan and discussed their apomorphies in detail. Kamaluddin, *et al.* (2000) attempted the cladistic analysis of 33-genera of the sub-family Trifinae from Indo-Pakistan subcontinent. Naz *et al.* (2007) described *Trigonodes disjuncta* Moore first time from Pakistan with its sadistic relationship.

Materials and Methods

The characters were studied from the entire body of both males and females sexes where available and by the literature at hand and the taxa are compared with those found in the out-group within the sub-family Plusiinae. A cladogram showing relationships of the included taxa a_o, b_o, c_o, d_o etc., indicate plesiomorphic and states 1, 2, 3 etc and any character in ascending order reflect derived, more derived, specially derived states.

CLADISTIC ANALYSIS OF THE SUB- FAMILY PLUSIINAE (BOISDUVAL)

Results

Character codes:

a_0 Body generally dull colour and smooth.
a_1 Body generally robust (In all Plusiinae and Arctinae).
a_2 Body usually brown in colour (In all Plusiinae).
a_3 Body brilliantly colour (In all Arctinae).
b_0 Adult are minute sized.
b_1 Adult are medium sized (In all Plusiinae and Arctinae).
c_0 Vertex smooth.
c_1 Vertex only slightly raised or not (*Trichoplusia ni* to *Pseudoplusia includens*).
c_2 Vertex slightly raised (*Trichoplusia ni* and *Chrysodeixis acuta*).
c_3 Vertex highly raised (*Thysanoplusia orichalcia*).
d_0 Frons not produced.
d_1 Frons anteriorly sub-roundely produced (*Autographa argyrosigna* to *Megalographa biloba*).
d_2 Frons slightly produced (*Chrysodeixis eriosoma* and *Peudoplusia includens*).
d_3 Frons well produced (*Trichoplusia ni* and *Chrysodeixis acuta*).
d_4 Frons rounded (*Diachrysia neostenochrysis*) .
d_5 Frons anteriorly sub-acutely produced (*Autographa gamma*).
d_6 Frons acutely produced (*Diachrysia rawlaensis*).
e_0 Eye without lashes.
e_1 Eye with eye-lashes (In all plusiinae).
f_o Palpi anterioly directed.

f_1 Palpi anterio-leterally turned (*Euchalcia neostilpna* and *Euchalcia emichi*).
f_2 Palpi upturned reaching vertex (*Euchalcia hedeja*).
g_0 Position of palpi.
g_1 Palpi with basal segment about equal or slightly short than 2nd segment (*Autographa gamma* to *Megalographa biloba*).
g_2 Basal segment always shorter than 2nd segment (*Diachrysia balluca* to *Megalographa biloba*).
g_3 Palpi with basal segment much shorter than 2nd and about equal to 3rd segment (*Allagrapha aereoides* to *Allagrapha zubairi*).
g_4 Palpi with basal segment about 1/2 the length of 2nd segment (*Diachrysia neostenochrysis*).
g_5 Palpi with basal segment much longer than 2nd and about 3X the 3rd segment (*Allagrapha aerea*).
h_0 Palpi with 2nd or 3rd segment normal.
h_1 Palpi with 3rd segment usually moderate or large (*Macdunnoughia confusa* to *Megalographa biloba*).
h_2 Palpi with 3rd segment minute (*Argyrogramma signata*).
h_3 Palpi with 2nd segment distally narrowed (*Allagrapha zubairi*).
h_4 Palpi with 2nd segment distally thick (*Allagrapha kashmiriensis*).
i_0 Palpi with 2nd segment much longer than basal segment.
i_1 Palpi with 2nd segment less than 2X the basal segment (*Allagrapha kashmiriensis* and *Allagrapha zubairi*).
i_2 Palpi with 2nd segment more than 2X the basal segment (*Allagrapha aereoides*).
i_3 Palpi with 2nd segment equal to basal and slightly longer than 3rd segment (*Chrysodeixis eriosoma*).
i_4 Palpi with 2nd segment about 2X the basal and about 1.7X the 3rd segment (*Pseudoplusia includens*).
j_0 Palpi with 3rd segment much shorter than basal segment.
j_1 Palpi with 3rd segment usually equal or longer than basal segment sometime basal segment much longer the 2nd (*Allagrapha aerea to Allagrapha zubairi).*
j_2 Palpi with 3rd segment shorter than basal segment *(Diachrysia balluca* to *Megalographa biloba*).
k_0 Palpi with 2nd segment more than the 3rd segment.
k_1 Palpi with 2nd segment less than 2X the 3rd segment (*Trichoplusia ni* and *Chrysodeixis acuta*).
k_2 Palpi with 2nd segment more than 2X the 3rd segment (*Chrysodeixis eriosoma* and *Pseudoplusia includens*).
k_3 Maxillary palpi with 2nd segment less than 6X the length of 3rd segment (*Thysanoplusia orichalcia* to *Megalographa biloba*).
k_4 Palpi with 2nd segment 2X the 3rd segment (*Diachrysia neostenochrysis*).
k_5 palpi with 2nd segment 5X the length of 3rd segment (*Diachrysia rawlaensis*).
k_6 Maxillary palpi with 2nd segment more than 6X the 3rd segment (*Abrostola bettoni*).
l_0 Third segment equal to 2nd segment.
l_1 Third segment of palpi equal or less than 1/2 the length of 2nd segment (*Allagrapha aerea* to *Megalographa biloba*).
l_2 Third segment of palpi more than 1/2 the length of 2nd segment (*Euchalcia neostilpna* , *Euchalcia hedeja* and *Euchalcia emichi*).
l_3 Palpi with 3rdsegment much shorter than 2nd segment (*Euchalcia neostilpna* and *Euchalcia emichi*).
l_4 Palpi with 3rd segment slightly shorter than 2nd segment (*Euchalcia hedeja*).
m_0 Fore wings more than 13-veins.
m_1 Fore wings with 12-veins, R_3 and R_4 originating from cell (*Allagrapha kashmiriensis and Allagrapha zubairi*).
m_2 Fore wings with 13-veins, R_4 and R_5 originating from cell (*Allagrapha aerea*).
n_0 For wings entire.
n_1 Fore wings usually an elongated cell at the base of Radius veins (*Abrostola bettoni* to *Megalographa biloba*).
n_2 Fore wings without transverse bands (*Thysanoplusia orichalcia* to *Pseudoplusia includens*).
n_3 Fore wings with transverse band and loop and a spot (*Argyrogramma signata* to *Megalographa biloba*).
o_0 Fore wings with anterior margin straight.
o_1 Fore wings with anterior margin sinuated (*Allagrapha aereoides* to *Allagrapha zubairi*).
o_2 Fore wings with anterior margin convex (*Allagrapha aerea*).
p_0 Fore wings apical margin straight.
p_1 Apical margin of fore wings crenulated (*Diachrysia rawlaensis* and *Diachrysia neostenochrysis*).
p_2 Apical margin of fore wings distinctly sinuated (*Diachrysia balluca*).
q_0 Fore wings with three anal veins.
q_1 Only one anal vein present (*Autographa nigrisigna*).
q_2 Two anal veins present (*Megalographa biloba*).
r_0 Fore wings with Sc and R_1 parallel.

r_1 Fore wings with veins Sc and R_1 usually not stalked (*Argyrogramma signata* to *Megalographa biloba*).
r_2 Fore wings with veins Sc and R_1 largely stalked and originating from above angle of cell (*Argyrogramma signata*).
s_0 Fore wings with position of veins R_1 to R_5 wide apart to each other.
s_1 Fore wings with veins R_1 and R_2 wide apart, R_3 and R_4 moderately stalked either anastomosing with R_5 or not (*Trichoplusia ni* to *Pseudoplusia includens*).
s_2 Fore wings with veins R_1 and R_2 very largely stalked, R_3 and R_4 very largely stalked further stalked with R_5 (*Thysanoplusia orichalcia*).
s_3 Fore wings with veins R_2 and R_3 stalked and originating from above upper angle of cell (*Autographa nigrisigna*).
t_0 Fore wings with veins R_3 and R_4 very wide apart.
t_1 Fore wings with veins R_3 and R_4 wide apart (*Autographa nigrisigna* and *Megalographa biloba*).
t_2 Fore wings with veins R_3, R_4 and R_5 not anastomosing and not all veins originating from upper angle of cell (*Macdunnoughia confusa* to *Megalographa biloba*).
t_3 Fore wings with veins R_3 and R_4 shorter and stalked (*Trichoplusia ni*).
t_4 Fore wings with veins R_3 and R_4 stalked (*Autographa argyrosigna*).
t_5 Fore wings with veins R_3 and R_4 largely stalked, M_2 and M_3 anastomosing (*Chrysodeixis acuta*).
t_6 Fore wings with veins R_3 and R_4 anastomosing and originating from upper angle of cell (*Diachrysia neostilpna*).
t_7 Fore wings with veins R_3 and R_4 stalked and further stalked with R_5, anastomosing with R_2 and originating from upper angle of cell (*Diachrysia rawlaensis*).
t_8 Fore wings with veins R_3 and R_4 largely stalked further stalked with R_5 and originating from upper angle of cell (*Euchalcia neostilpna*).
t_9 Fore wings with veins R_3 and R_4 largely stalked and originating from above upper angle of cell (*Euchalcia emichi*).
u_0 hind wings with many anal veins.
u_1 Hind wings with 2-anal veins (*Euchalcia neostilpna* and *Euchalcia emichi*).
u_2 Hind wings with one anal vein (*Autographa gamma*).
u_3 Hind wings with 3-anal veins (*Euchalcia hedeja*).
v_o Hind wings with veins $Sc+R_1$ close to costal margin.
v_1 Hind wings with $Sc+R_1$ wide apart not unit with Rs (*Chrysodeixis acuta*).
v_2 Hind wings with $Sc+R_1$ unit with Rs near base (*Trichoplusia ni*).
w_0 Hind wings with veins Rs and M_1 very wide apart.
w_1 Hind wings with veins Rs and M_1 anastomosing and originating from upper angle of cell. (*Autographa nigrisigna* and *Megalographa biloba*).
w_2 Hind wings with veins Rs and M_1 wide apart, only M_1 originates from upper angle of cell (*Autographa argyrosigna*).
w_3 Hind wings with Rs and M_1 not anastomosing, M_1 originates from upper angle of cell (*Pseudoplusia includens*).
w_4 Hind wings with veins Rs originates just above upper angle of cell (*Allagrapha aerea*).
x_0 Tympanal hood absent.
x_1 Two tympanal hood present (*Abrostola bettoni* to Arctidae).
y_0 Secondary hair bushes very large on 8^{th} segment.
y_1 Secondary hair bushes on 8^{th} sternum wanting (*Autographa signata* to *Megalographa biloba*).
y_2 Secondary hair bushes arising on 8^{th} segment (*Pseudoplusia includens*).
z_0 Tibiae with spines and spurs.
z_1 Tibiae with spines (*Thysanoplusia orichalcia* to *Megalographa biloba*).
z_2 Tibiae smooth without spines (*Abrostola bettoni*).
za_0 Abdomen unicolorus and without tuft.
za_1 Abdomen with brilliently coloured patches on dorsal and ventral side (all Arctinae).
za_2 Male usually have additional abdominal tuft, intersegmental membranes of segment 4-7. (*Thysanoplusia orichalcia* to *Pseudoplusia includens*).
zb_0 Papillae anales rounded.
zb_1 Papillae anales usually smooth at base (*Thysanoplusia orichalcia* to *Megalographa biloba*).
zb_2 Papillae anales triangular-shaped (*Allagrapha kashmiriensis* to *Allagrapha zubairi*).
zb_3 Papillae anales pear-shaped (*Trichoplusia ni* to *Pseudolpusia includens*).
zb_4 Papillae anales quadrangular (*Thysanoplusia orichalcia*).
zb_5 Papillae anales rectangular-shaped (*Abrostola bettoni*).
zb_6 Apex of papillae anales sub-rounded (*Allagrapha zubairi*).
zb_7 Papillae anales oval-shaped (*Autographa nigrisigna*).

zb_8 Apex of papillae anales truncated (*Allagrapha kashmiriensis*).
zb_9 Papillae anales lunar-shaped (*Euchalcia hedeja*).
zc_0 Apophysesses short and entire.
zc_1 Both apophysesses about equal in length (*Autographa nigrisigna* and *Megalographa biloba*).
zc_2 Apophyses anteriors narrowed and apophyses posteriors pointed (*Allagrapha kashmiriensis*).
zc_3 Base of apophyses posteriors smooth (*Allagrapha zubairi*).
zc4 Base of apophyses posteriors dilated (*Allagrapha kashmiriensis*).
zc_5 Apophyses posteriors much dilated at base (*Abrostola bettoni*).
zc_6 Apophyses anteriors broad, apex clubbed-shaped much longer than apophyses posteriors (*Allagrapha aereoides*).
zd_0 Lobus vaginalis short.
zd_1 Lobus vaginalis moderate (*Allagrapha kashmiriensis* and *Allagrapha zubairi*).
zd_2 Lobus vaginalis large anteriorly broad (*Allagrapha aereoides*).
ze_0 Ductus bursae very short.
ze_1 Ductus bursae large narrowed (*Thysanoplusia orichalcia* to *Megalographa biloba*).
ze_2 Ductus bursae mediam sized (*Autographa nigrisigna*).
ze_3 Ductus bursae moderate broad (*Chrysodeixis acuta*).
ze_4 Ductus bursae short proximally narrowed (*Allagrapha zubairi*).
ze_5 Ductus bursae very large (*Megalographa biloba*).
ze_6 Ductus bursae long proximally dilated (*Allagrapha kashmiriensis*).
ze_7 Ductus bursae very large twisted (*Trichoplusai ni*).
zf_0 Corpus bursae simple balloon-shaped entire.
zf_1 Corpus bursae typical (*Allagrapha aereoides*).
zf_2 Corpus bursae simple with a ring-like cornuti (*Allagrapha aerea*).
zf_3 Corpus bursae large oval-shaped with cornuti (*Chrysodeixis acuta*).
zf_4 Corpus bursae kidney-shaped (*Megalographa biloba*).
zf_5 Corpus bursae very large balloon-like (*Allagrapha zubairi*).
zf_6 Corpus bursae pitcher-like (*Trichoplusai ni*).
zf_7 Corpus bursae bilobed proximally circular (*Allagrapha kashmiriensis*).
zg_0 Tagumen oblongate.
zg_1 Tegumen elongated (*Diachrysia rawlaensis* and *Diachrysia neostenochrsis*).
zg_2 Tegumen broad, pitcher- like (*Diachrysia balluca*).
zh_0 Saccus broad.
zh_1 Saccus narrowed (*Macdunnoughia confusa* to *Megalographa biloba*).
zh_2 Saccus large cup- shaped (*Argyrogramma signata*).
zi_0 Uncus very large and smooth.
zi_1 Uncus narrowed about equal to gnathos (*Diachrysia rawlaensis* and *Diachrysia neostenochrysis*).
zi_2 Uncus thick much longer than gnathos (*Diachrysia balluca*).
zi_3 Uncus lunar -shaped (*Autographa argyrosigna*).
zj_0 Gnathos very large and simple.
zj_1 Gnathos reduced (*Euchalcia emichi*).
zj_2 Gnathos large about equal to uncus (*Chrysodiexis eriosoma*).
zj_3 Gnathos large elbow- shaped (*Euchalcia neostilpna*).
zk_0 Paramere as long as broad.
$_zk_1$ Paramere much longer than tegumen (*Autographa gamma* to *Megalogrpha biloba*).
$_zk_2$ Paramere much shorter than tegumen (*Diachrysia rawlaensis*).
$_zl_o$ Apex of paramere broadly convex.
$_zl_1$ Apex of Paramere broad (*Pseudoplusia includens*).
$_zl_2$ Apex of Paramere narrowed (*Chrysodeixis eriosoma*).
$_zl_3$ Paramere short with apex sub- acute (*Diachrysia rawlaensis*).
$_zl_4$ Paramere very short with pointed apex (*Diachrysia balluca*).
zm_0 Paramere simple.
zm_1 Paramere usually typical bifurcated (Arctidae).
zm_2 Paramere unilobed (*Euchalcia hedeja* to *Megalographa biloba*).
zm_3 Paramere with an inner median process directed posteriad (*Autographa argyrogramma* to *Megalographa biloba*).
zm_4 Paramere flipper- like (*Euchalcia neostilpna*).
zm_5 Paramere proximally very broad oval- shaped (*Euchalcia emichi*).
zm_6 Paramere with an inner-median process directed anteriad (*Autographa gamma*).

zm_7 Paramere bilobed, outer margin of inner lobe dentate, apex of outer lobe pointed beak-shaped, a large hook-shaped process at inner basal margin (*Macdunnoughia confusa*).
zn_0 Theca simple, moderate.
zn_1 Theca broad, tubular (*Macdunnougia confusa* to *Megalographa biloba*).
zn_2 Theca short with short membranous conjunctival lobe (*Euchalcia hedeja* to *Euchalcia emichi*).
zn_3 Theca large with large membranous conjunctival lobe (*Allagrapha aerea* to *Megalographa biloba*).
zn_4 Theca distally very narrowed (*Argyrogramma signata*).
zn_5 Theca distally medially notched (*Autographa argyrosigna*).
zn_6 Theca with 3-spine-like thecal appendages (*Euchalcia neostilpna*).
zn_7 Theca with 3-thecal appendages median and inner with dentition (*Diachrysia balluca*).
zo_0 Membranous conjunctival lobe simple.
zo_1 Membranous conjunctival lobe moderate without or with more than one cornuti (*Macdunnougia confusa* to *Megalographa biloba*).
zo_2 Membranous conjunctival lobe very large with a large no of cornuti (*Trichoplusia ni* to *Pseudoplusia includens*).
zo_3 Membranous conjunctival lobe with a blunt thorn-like appendage at apex (*Autographa argyrosigna* and *Megalographa biloba*).
zo_4 Membranous conjunctival lobe very large, unilobed (*Pseudoplusia includens*).
zo_5 Membranous conjunctiva bilobed, moderate (*Chrysodeixis eriosoma*).
zo_6 Membranous conjunctival lobe short with a rod-like appendage (*Thysanoplusia orichalcia*).
zo_7 Membranous conjunctival lobe very large distally with a large sclerotized blade-like cornuti (*Argyrogramma signata*).
zo_8 Membranous conjunctival lobe short with small ring-like cornuti at inner side (*Diachrysia rawlaensis*).
zo_9 Membranous conjunctival lobe with a sickle-shaped appendage at apex (*Autographa gamma*).
zo_{10} Membranous conjunctival lobe with sex-comb of 7-teeth and a group of small spine-like cornuti (*Macdunnoughia confusa*).

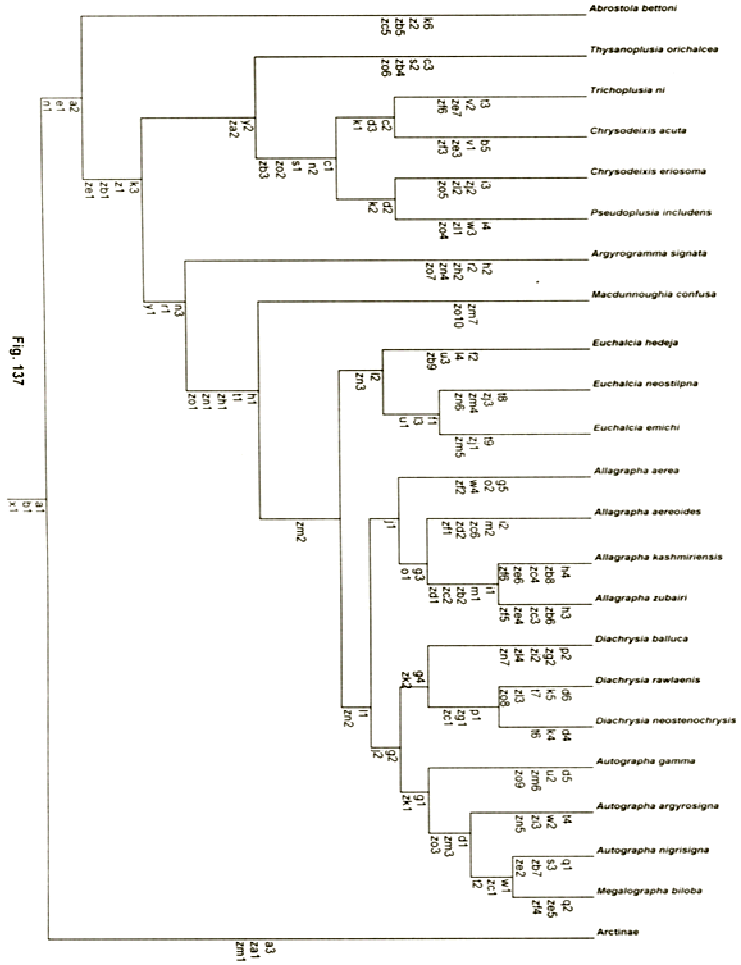

Fig. 1. Cladogram showing cladistic analysis of Plusiinae taxa

Character states

Body shape (a): Body generally robust in all plusiine and all arctine moths show their synapomorphic condition (a_1). In the representatives of the sub-family Plusiinae the body colour usually brown shows their derived synapomorphic condition (a_2). The body generally brilliantly coloured in all the representatives of the sub-family Arctinae shows their more derived synapomorphic condition (a_3).

Body size (b): The adults are of medium sized in all the representatives of the sub-family Plusiinae and Arctinae shows their synapomorphic condition (b_1).

Vertex (c): Vertex slightly raised or not in the representatives of the genus *Trichoplusia* to *Pseudoplusia* shows their synapomorphic condition (c_1). In *Trichoplusia ni* and *Chrysodeixis acuta* the vertex is slightly raised shows their derived synapomorphic condition (c_2). The vertex highly raised in *Thysanoplusia orichalcia* shows its autapomorphic condition (c_3).

Frons (d): Frons anteriarly sub-roundly produced in *Autographa argyrosigna, A. nigrisigna* and *Megalographa biloba* shows their synapomorphic condition (d_1). In the genera *Chrysodeixis eriosoma* and *Pseudoplusia includens* the frons slightly produced shows their derived synapomorphic condition (d_2). Frons well produced in *Trichoplusia ni* and *Chrysodeixis acuta* shows their more derived synapomorphic condition (d_3). In *Diachrysia neostenochrysis* frons rounded shows its autapomorphic codition (d_4). Frons anteriarly sub-acutely produced in *Autographa gamma* shows its derived autapomorphic condition (d_5). In *Diachrysia rawlaensis* the frons acutely produced shows its more derived autapomorphic condition (d_6).

Eye (e): Eyes with eye lashes in all the representatives of the sub-family Plusiinae shows their synapomorphic condition (e_1).

Position of palpi (f): Palpi antero-laterally projected in *Euchalcia neostilpna* and *Euchalcia emichi* shows their synapomorphic condition (f_1). In *Euchalcia hedeja* the palpi upturned and reaching vertex of head shows its autapomorphic condition (f_2).

Palpi with basal segment/ 2nd segment (g): Palpi with basal segment about equal or slightly shorter than 2nd segment in the representatives of the genus *Autographa* and *Megalographa* shows their synapomorphic condition (g_1). In the representatives of the genus *Diachrysia* and *Megalographa* the basal segment always shorter than 2nd shows their derived synapomorphic condition (g_2). The palpi with basal segment much shorter than 2nd and about equal to 3rd segment in *Allagrapha aereoides, A. kashmiriensis* and *A. zubairi* shows their more derived synapomorphic condition (g_3). In *Diachrysia balluca, D. rawlaensis* and *D. neostenochrysis* the palpi with basal segment about half the length of 2nd segment shows its specially derived synapomorphic condition (g_4). The palpi with basal segment much longer than 2nd and about 3X the length of 3rd in *Allagrapha aerea* shows its autapomorphic condition (g_5).

Position of second and third segment of palpus (h): Palpi with third segment usually moderate or large from the genera *Macdunnoughia* to *Megalographa* shows their synapomorphic condition (h_1). In *Argyrogramma signata* the palpi with 3rd minute shows its autapomorphic condition (h_2). Palpi with second segment distinctly narrowed in *Allagrapha zubairi* shows its derived autapomorphic condition (h_3). In *Allagrapha kashmiriensis* the palpi with second segment distally thick shows its more derived autapomorphic condition (h_4).

Palpi with second segment and basal segment (i): Palpi with second segment less than 2X the length of basal segment in *Allagrapha kashmiriensis* and *Allagrapha zubairi* shows their synapomorphic condition (i_1). In *Allagrapha aereoides* the palpi with second segment shows its autapomorphic condition (i_2). Palpi with second segment equal to basal and slightly longer than third segment in *Chrysodeixis eriosoma* shows its derived autapomorphic condition (i_3). In *Pseudoplusia includens* the second segment of palpus about twice the basal and about 1.7X the length of third segments shows its more derived autapomorphic condition (i_4).

Position of third/ basal segment of palpi (j): Palpi with third segment usually equal or longer than basal segment and sometimes basal segment much longer than 2nd segment in *Allagrapha aerea, A. aereoides, A. kashmiriensis* and *A. zubairi* shows their synapomorphic codition (j_1). In the representatives of the genera *Diachrysia* and *Megalographa* the third segment of palpi shorter than basal segment shows their derived synapomorphic condition (j_2).

Palpi with second segment and third segment (k): Palpi with second segment less than twice the length of third segment in *Trichoplusia ni* and *Chrysodeixis acuta* shows their synapomorphic condition (k_1). In

Chrysodeixis eriosoma and *Pseudoplusia includens* the second segment of palpi more than twice the length of third shows their derived synapomorphic condition (k_2). The palpi with second segment less than 6X the length of third segment the representatives of the genera *Thysanoplusia* to *Megalographa* shows their more derived synapomorphic condition (k_3). In *Diachrysia neostenochrysis* the second segment of palpi twice the length of 3rd segment shows its autapomorphic condition (k_4). The second segment of palpai five times the length of 3rd segment in Diachrysia rawlaensis shows its derived autapomorphic condition (K_5). In *Abrostola bettoni* the second segment of palpi more than six times the length of third segment shows its more derived autapomorphic condition (k_6).

Palpi with 3rd segment and second segment (l): Third segment of palpi equal to half or less than half the length of second segment in the representatives of the genera *Allagrapha, Diachrysia, Autographa* and *Megalographa* shows their synapomorphic condition (l_1). In *Euchalcia hedeja, E. neostilpna* and *E. emichi* the third segment of palpi more than half the length of second segment shows their derived synapomorphic condition (l_2). Palpi with third segment much shorter than second segment. In *Euchalcia neostilpna* and *E. emichi* shows their more derived synapomorphic condition (l_3). In *Euchalcia hedeja* the third segment of palpi slightly shorter than second segment shows its autapomorphic condition (l_4).

Number of veins in fore wings (m): Fore wings with 12-veins and veins R_3 and R_1 originating from cell in *Allagrapha kashmiriensis* and *A. zubairi* shows their synapomorphic condition (m_1). In *Allagrapha aereoides* the fore wings with 13-veins and veins R_4 and R_5 originating from cell shows its autapomorphic condition (m_2).

Shape of cell and bands on fore wings (n): Fore wings usually with an elongated cell at base of radius veins in all representatives of the genera *Abrostola* to *Megalographa* shows their synapomorphic condition (n_1). In the species of the genera *Trichoplusia, Chrysodeixis* and *Pseudoplusia* the fore wings entire without transverse band shows their derived synapomorphic condition (n_2). Fore wings with transverse band, loop and a spot in the species of the genera *Argyrogramma* to *Megalographa* shows their more derived autapomorphic condition (n_3).

Anterior margin of fore wings (o): Fore wings with anterior margins sinuated in *Allagrapha aereoides, A. kashmiriensis* and *A. zubairi* shows their synapomorphic condition (o_1). In *Allagrpha aerea* the fore wings with anterior margin sinuated shows its autapomorphic condition (o_2).
Apical margin of fore wings (p): Apical margin of fore wings crenulated in *Diachrysia rawlaensis* and *D. neostenochrysis* shows their synapomorphic condition (p_1). In *Diachrysia balluca* apical margin of fore wings distinctly sinuated shows its autapomorphic condition (p_2).

Number of anal veins in fore wings (q): Fore wings with one anal veins in *Autographa nigrisigna* shows its autapomorphic condition (q_1). In *Megalographa biloba* two anal veins present in fore wings shows its derived autapomorphic condition (q_2).

Fore wings with veins Sc and R_1 (r): Fore wings with veins Sc and R_1 usually not stalked in the species of the genera *Argyrogramma* to *Megalographa* shows their synapomorphic condition (r_1). In *Argyrogramma signata* fore wings with veins Sc and R_1 largely stalked and originating from above upper angle of cell shows its autapomorphic condition (r_2).

Fore wings with position of veins R_1 to R_5 (s): Fore wings with veins R_1 and R_2 wide apart and R_3 and R_4 moderately stalked either anastomosing with R_5 or not in the species of the genera *Trichoplusia, Chrysodeixis* and *Pseudoplusia* shows their synapomorphic condition (s_1). In *Thysanolpusia orichalcia* the fore wings with veins R_1 and R_2 very largely stalked and veins R_3 and R_4 largely stalked further stalked with R_5 shows its autapomorphic condition (s_2). The fore wings with veins R_2 and R_3 stalked and originating from above upper angle of cell in *Autographa nigrisigna* shows its derived autapomorphic condition (s_3).

Fore wings with veins R_3, R_4 and R_5 (t): Fore wings with veins R_3, R_4 and R_5 not anastomosing and not all veins originating from upper angle of cell in the species of the genera *Macdunnoughia* to *Megalographa* shows their synapomorphic condition (t_1). In the species of the genera *Autographa* and *Megalographa* fore wings with veins R_3 and R_4 wide apart shows their derived synapomorphic condition (t_2). Fore wings with veins R_3 and R_4 shorter and stalked in *Trichoplusia ni* shows its autapomorphic condition (t_3). In *Autographa argyrosigna* the fore wings with veins R_3 and R_4 stalked shows its derived autapomorphic condition (t_4). In *Chrysodeixis acuta* the fore wings with veins R_3 and R_4 largely stalked and M_2 and M_3 anastomosing shows its more derived autapomorphic condition (t_5). Fore wings with veins R_3 and R_4 anastomosing and originating

from upper angle of cell in *Diachrysia neostinochrysis* shows its specially autapomorphic condition (t_6). In *Diachrysia rawlaensis* the fore wings with veins R_3 and R_4 stalked further stalked with R_5, anastomosing with R_2 and originating from upper angle of cell shows its specially derived autapomorphic condition (t_7). Fore wings with veins R_3 and R_4 largely stalked further stalked with R_5 and originating from upper angle of cell in *Euchalcia neostilpna* shows its specially more derived autapomorphic condition (t_8). In *Euchalcia emichi* the fore wings with veins R_3 and R_4 largely stalked and originating from above upper angle of cell and only R_5 originating from upper angle of cell shows its more specialized autapomorphic condition (t_9).

Number of anal veins in hind wings (u): Hind wings with two anal veins in *Euchalcia neostilpna* and *Euchalcia emichi* shows their synapomorphic condition (u_1). In *Autographa gamma* the hind wings with only one anal vein shows its derived autapomorphic condition (u_2). The hind wings with three anal veins in *Euchalcia hedeja* shows its more derived autapomorphic condition (u_3).

Position of veins Sc+R_1 and Rs in hind wings (v): Hind wings with Sc+R_1 wide apart not unite with Rs in *Chrysodeixis acuta* shows its autapomorphic condition (v_1). In *Trichoplusia ni* the hind wings with Sc+R_1 unite with Rs near base shows its derived autapomorphic condition (v_2).

Position of veins Rs and M_1 on hind wings (w): Hind wings with veins Rs and M_1 anastomosing and originating from upper angle of cell in *Autographa nigrisigna* and *Megalographa biloba* shows their synapomorphic condition (w_1). In *Autographa argyrosigna* the hind wings with veins Rs and M_1 wide apart and only M_1 originating from upper angle of cell shows its autapomorphic condition (w_2). Hind wings with Rs and M_1 not anastomosing and M_1 originating from upper angle of cell in *Pseudoplusia includense* shows its derived autapomorphic condition (w_3). In *Allagrapha aerea* the hind wings with veins Rs originates just above upper angle of cell shows its more derived autapomorphic condition (w_4).

Tympanal hood (x): Two tympanal hoods are present in all the representatives of the sub-family Plusiinae and Arctinae shows their synapomorphic condition (x_1).

Secondary hair brushes on 8th sternum (y): Secondary hair brushes on 8th sternum wanting in the species of the genera *Argyrogramma* to *Megalographa* shows their synapomorphic condition (y_1). In the species of the genera the secondary hair brushes arising on 8th segment in *Thysanoplusia*, *Trichoplusia*, *Chrysodeixis* and *Pseudoplusia* show their derived synapomorphic condition (y_2).

Spines on tibiae (z): Tibiae with spines in the representatives of the genera *Thysanoplusia* to *Megalographa* shows their synapomorphic condition (z_1). In *Abrostola bettoni* the tibiae smooth and spines are wanting shows its autapomorphic condition (z_2).

Abdomen (za): Abdomen with brilliantly coloured patches on dorsal and ventral side in all the representatives of the sub-family Arctinae shows their synapomorphic condition (za_1). In the species of the genera *Thysanoplusia*, *Trichoplusia*, *Chrysodeixis* and *Pseudoplusia* the males usually have additional abdominal tuft on intersegmental membrane from 4-7 segments shows their derived synapomorphic condition (za_2).

Papillae anales (zb): Papillae anales usually smooth at base in the species of the genera *Thysanoplusia* to *Megalographa* shows their synapomorphic condition (zb_1). In *Allagrapha kashmiriensis* and *Allagrapha zubairi* the papillae anales triangular shaped shows their derived synapomorphic condition (zb_2). The papillae anales pear-shaped in *Trichoplusia ni*, *Chrysodeixis acuta*, *C. eriosoma* and *Pseudoplusia includens* shows their more derived synapomorphic condition (zb_3). In *Thysanoplusia orichalcia* the papillae anales quadrangular-shaped shows its autapomorphic condition (zb_4). The papillae anales rectangular-shaped in *Abrostola bettoni* shows its derived autapomorphic condition (zb_5). In *Allagrapha zubairi* apex of papillae anales sub-rounded shows its more derived autapomorphic condition (zb_6). The papillae anales oval-shaped in *Autographa nigrisigna* shows its specially autapomorphic condition (zb_7). In *Allagrapha kashmiriensis* the apex of papillae anales truncated shows its specially derived autapomorphic condition (zb_8). The papillae anales lunar-shaped in *Euchalcia hedeja* shows its specially more derived autapomorphic condition (zb_9).

Apophysesses (zc): Both apophysesses are about equal in length in *Autographa nigrisigna* and *Megalographa biloba* shows their synapomorphic condition (zc_1). In *Allagrapha kashmiriensis* and *A. zubairi* the apophyses anteriors narrowed with apex pointed and shorter than apophyses posteriors shows their derived synapomorphic condition (zc_2). The base of apophyses posteriors smooth in *Allagrapha zubairi* shows its autapomorphic condition (zc_3). In *Allagrapha kashmiriensis* the base of apophyses posteriors dilated shows its derived autapomorphic condition (zc_4). The apophyses posteriors much dilated at base in *Abrostola bettoni* shows its more derived autapomorphic condition (zc_5). In *Allagrapha aereoides* the apophyses anteriars broad,

apex club-shaped much longer than apophyses posteriors shows its specially derived autapomorphic condition (zc_6).

Lobus vaginalis (zd): Lobus vaginalis moderate in *Allagrapha kashmiriensis* and *A. zubairi* shows their synapomorphic condition (zd_1). In *Allagrapha aereoides* lobus vaginalis large anteriarly broad shows its autapomorphic condition (zd_2).

Ductus bursae (ze): Ductus bursae large and narrowed in the representatives of the genera *Thysanoplusia* to *Megalographa biloba* shows their synapomorphic condition (ze_1). In *Autographa nigrisigna* the ductus bursea medium sized shows its autapomorphic condition (ze_2). The ductus bursae moderate and broad in *Chrysodeixis acuta* show its derived autapomorphic condition (ze_3). In *Allagrapha zubairi* ductus bursae short, proximally narrowed shows its more derived autapomorphic condition (ze_4). Ductus bursae very large in *Megalographa biloba* shows its specially autapomorphic condition (ze_5). In *Allagrapha kashmiriensis* the ductus bursae long proximally dilated shows its specially derived autapomorphic condition (ze_6). The ductus bursae very long twisted in *Trichoplusia ni* shows its specially more derived autapomorphic condition (ze_7).

Corpus bursae (zf): Corpus bursae typical in *Allagrapha aereoides* shows its autapomorphic condition (zf_1). In *Allagrapha aerea* the corpus bursae simple with a ringlike cornuti shows its derived autapomorphic condition (zf_2). Corpus bursae large, oval shaped with cornuti in *Chrysodeixis acuta* shows its more derived autapomorphic condition (zf_3). In *Megalographa biloba* the corpus bursae kidney shaped shows its specially autapomorphic condition (zf_4). In *Allagrapha zubairi* the corpus bursae very large balloon-shaped shows its specially derived autapomorphic condition (zf_5). The corpus bursae is pitcher-like in *Trichoplusia ni* shows its specially more derived autapomorphic condition (zf_6). In *Allagrapha kashmiriensis* the corpus bursae bilobed proximally circular shows its peculiar autapomorphic condition (zf_7).

Tegumen (zg): The tegumen elongated in *Diachrysia rawlaensis* and *D. neostenochrysis* shows their synapomorphic condition (zg_1). In *Diachrysia balluca* the tegumen broad, pitcher-like shows its autapomorphic condition (zg_2).

Saccus (zh): Saccus narrowed in the representative of the genera *Macdunnoughia confusa* to *Megalographa biloba* shows their synapomorphic condition (zh_1). In *Argyrogramma signata* the saccus large cup-shaped shows its autapomorphic condition (zh_2).

Uncus (zi): Uncus narrowed about equal to gnathos in *Diachrysia rawlaensis* and *D. neostenochrysis* shows its synapomorphic condition (zi_1). In *Diachrysia balluca* the uncus thick much longer than gnathos shows its autapomorphic condition (zi_2). The uncus lunar-shaped in *Autographa argyrosigna* shows its derived autapomorphic condition (zi_3).

Gnathos (zj): Gnathos reduced in *Euchalcia emichi* shows its autapomorphic condition (zj_1). In *Chrysodeixis eriosoma* the gnathos large about equal to uncus shows its derived autapomorphic condition (zj_2). The gnathos large elbow-shaped in *Euchalcia neostilpna* shows its more derived autapomorphic condition (zj_3).

Size of paramere (zk): The paramere much longer than tegumen in *Autographa gamma*, *A. argyrosigna*, *A. nigrisigna* and *Megalographa biloba* shows their synapomorphic condition (zk_1). In *Diachrysia balluca*, *D. rawlaensis* and *D. neostenochrysis* the paramere is much shorter than tegumen shows its derived autapomorphic condition (zk_2).

Apex of paramere (zl): Apex of paramere broad in *Pseudoplusia includens* shows its autapomorphic condition (zl_1). In *chrysodeixis eriosoma* the apex of paramere narrowed shows its derived autapomorphic condition (zl_2). The paramere short with apex sub-acute in *Diachrysia rawlaensis* shows its more derived autapomorphic condition (zl_3). In *Diachrysia balluca* the paramere very short with pointed apex shows its specially derived autapomorphic condition (zl_4).

Shape of paramere (zm): Paramere usually typical bifurcated in all the representatives of the sub-family Arctinae shows there synapomorphic condition (zm_1). In the representatives of the genera *Euchalcia, Allagrapha, Diachrysia, Autographa* and *Megalographa* paramere unilobed shows their derived synapomorphic condition (zm_2). The paramere with an inner median process directed posteriard in *Autographa argyrosigna, A. nigrisigna* and *Megalographa biloba* shows their more derived synapomorphic condition (zm_3). In *Euchalcia neostilpna* the parameres are flipper-like shows its autapomorphic condition (zm_4). Paramere proximally very broad, oval-shaped in *Euchalcia emichi* shows its derived autapomorphic condition

(zm_5). In *Autographa gamma* the paramere with an inner-median process directed anteriad shows its more derived autapomorphic condition (zm_6). The paramere bilobed outer margin of inner lobe dentated, apex of outer lobe pointed beak-shaped, and a large hook-shaped process at inner basal margin in *Macdunnoughia confusa* shows its specially derived autapomorphic condition (zm_7).

Theca (zn): Theca broad and tubular in the representatives of the genera *Macdunnoughia, Euchalcia, Allagrapha, Diachrysia, Autographa* and *Megalographa* shows their synapomorphic condition (zn_1). In the representatives of the genera *Allagrapha, Diachrysia, Autographa* and *Megalographa* the theca large membranous conjunctival lobe shows their derived synapomorphic condition (zn_2). The theca short with short membranous conjunctival lobe in *Euchalcia hedeja, E. neostilpna* and *E. emichi* shows their more derived synapomorphic condition (zn_3). In *Argyrogramma signata* the theca distally very narrowed shows its autapomorphic condition (zn_4). The theca distally medially notched in *Autographa argyrosigna* shows its derived autapomorphic condition (zn_5). In *Euchalcia neostilpna* the theca with 3-spine-like thecal appendages shows its more derived autapomorphic condition (zn_6). Theca with 3-thecal appendages, the median and inner with dentitions in *Diachrysia balluca* shows its specially derived autapomorphic condition (zn_7).

Membranous conjunctival lobe (zo): Membranous conjunctival lobe moderate without or with more than one cornuti in the representatives of the genera *Macdunnoughia, Euchalcia, Allagrapha, Diachrysia, Autographa* and *Megalographa* shows their synapomorphic condition (zo_1). In the representatives of the genera *Trichoplusia, Chrysodeixis* and *Pseudoplusia* the membranous conjunctival lobe very large with a large number of cornuti shows their derived synapomorphic condition (zo_2). The membranous conjunctival lobe with blunt thorn-like appendages at apex in *Autographa argyrosigna*, *A. nigrisigna* and *Megalographa biloba* shows their more derived synapomorphic condition (zo_3). In *Pseudoplusia includens* the membranous conjunctiva very large, unilobe shows its autapomorphic condition (zo_4). Membranous conjunctiva moderate and bilobed in *Chrysodeixis eriosoma* shows its derived autapomorphic condition (zo_5). In *Thysanoplusia orichalcia* the membranous conjunctival lobe short with a rod-like appendage shows its more derived autapomorphic condition (zo_6). Membranous conjunctival lobe very large distally with a large sclerotized blade-like cornuti in *Argyrogramma signata* shows its specially autapomorphic condition (zo_7). In *Diachrysia rawlaensis* the membranous conjunctival lobe short with small ring-like cornuti at inner side shows its specially derived autapomorphic condition (zo_8). The membranous conjunctival lobe with a sickle-shaped appendage at apex in *Autographa gamma* shows its specially more derived autapomorphic condition (zo_9). In *Macdunnoughia confusa* the membranous conjunctival lobe with sex-comb of 7-theeth and a group of small spine-like cornuti shows its peculiarly derived autapomorphic condition (zo_{10}).

Discussion on cladogram. (Fig. 01): The sub-family Plusiinae comprises 12-genera and twenty two species from Pakistan and Azad Kashmir presently included. All these species play sister group relationship to each other by their synapomorphies like the body generally brown colour (a_2), eyes with eye lashes (l_1) and fore wings usually an elongated cell at the base of radius veins (n_1) and outgroup relationships in all arctine species by their synapomorphic condition like body generally brilliantly coloured (a_3), abdomen with body brilliantly coloured patches on dorsal and ventral side (za_1) and theca broad and tubular (zm_1).

Among the sub-family Plusiinae the *Abrostola bettoni* play outgroup relationship by their autapomorphies like the second segment of the palpi more than 6X the length of 3rd segment (k_6), the papillae anales triangular-shaped (zb_2) and the apophyses posteriors much dilated at base (zc_5) and sister group relationships with rest of the 21-species of the plusine by their synapomrophies like palpi with 2nd segment distinctly narrowed (k_3), tibiae with spine (z_1), papillae anales usually smooth at base (zb_1) and ductus bursae large and narrowed (ze_1).The rest of the species fall into two groups, the first group includes five species viz. *Thysanoplusia orichalcia, Trichoplusia ni, Chrysodeixis acuta, C. eriosoma* and *Pseudoplusia includens* and the second group includes sixteen species viz. *Argyrograma signata, Macdunnoughia confusa, Euchalcia hedeja, E. neostilpna, E. emichi, Allagrapha aerea, A. aereoides, A. kashmiriensis, A. zubairi, Diachrysia balluca, D. rawlaensis, D. neostenochrysis, Autographa gamma, A. argyrosigna, A. nigrisigna* and *Megalographa biloba*.

The representatives of the first group plays sister group relationships to each other by their synapomorphies like the secondary hair brushes arising on 8th segment (y_2) and the males usually have additional abdominal tuft on inter segmental membranes from 4-7 segment (za_2) and out-group relationships with second group by their synapomorphies like fore wings with transverse band, lobe and a spot (n_3), fore wings with veins Sc and R_1 usually not stalked (r_1).

Among first group the *Trichoplusia ni, Chrysodeixis acuta, C. eriosoma* and *Pseudoplusia includens* shows sister group relationship to each other by their synapomorphies like fore wings with veins R_1 and R_2 wide apart and R_3 and R_4 moderately stalked either anastomosing with R_5 or not, the membranous conjunctival lobe very large with a large number of cornuti (zo_2) and the papillae anales pear-shaped (zb_3) and outgroup relationship with *Thysanoplusia orichalcia* by its autapomorphic condition in having the vertex highly raised (c_3), the fore

wings with veins R_1 and R_2 very largely stalked and veins R_3 and R_4 largely stalked and further stalked with R_5 (s_2), the papillae anales quadrangular-shaped (zb_4) and membranous conjunctival lobe short with a rod-like appendage (zo_6). Further the *Chrsodeixis eriosoma* and *Pseudoplusia includens* play sister group relationship to each other by their synapomorphies like frons slightly produced (d_2) and the 2nd segment of palpi is more than 2X the length of 3rd segment (k_2) and outgroup relationship with *Trichoplusia ni* and *Chrysodeixis acuta* by their synapomorphies like vertex slightly raised (c_2), frons well produced (d_3) and palpi with 2nd segment less than 2X the length of 3rd segment (k_1).

The second group comprises 16-species, in which *Argyrogramma signata* plays outgroup relationship by its autapomorphies like, the palpi with 3rd segment minute (h_2), fore wings with veins Sc and R_1 largely stalked and originating from above angle of cell (r_2), the saccus large cup-shaped (zh_2), the theca distally very narrowed (zn_4) and the membranous conjunctival lobe very large distally with a large sclerotized blade-like cornuti (zo_7) and sister group relationship with rest of the 15-species by their synapomorphies like palpi with 3rd segment usually moderate or large (h_1), fore wings with veins R_3, R_4 and R_5 not anastomosing and not all veins originating from upper angle of cell (t_1), saccus narrowed (zh_1), theca broad and tubular (zn_1) and the membranous conjunctival lobe moderate without or with more than one cornuti (zo_1).

Among rest of the 15-species the *Macdunnoughia confusa* plays outgroup relationship by its autapomorphies like the paramere bilobed, the outer margin at inner lobe dentate, apex of outer lobe pointed beak-shaped and a large hook-shaped process at inner basal margin (zm_7) and the membranous conjunctival lobe with sex-comb of 7-teeth and a group of small spine-like cornuti (zo_{10}) and sister group relationship with rest of the 14-species by their synapomorphic character like the theca large with large membranous conjunctival lobe (zn_2).

The rest of the 14-species of the representatives of five genera viz. *Euchalcia*, *Allagrapha*, *Diachrysia*, *Autographa* and *Megalographa* fall into two groups, the first group includes three species of the genus *Euchalcia* and second group includes rest of the eleven species of the four genera. The first group includes *Euchalcia neostilpna, E. emichi* and *E. hedeja* plays sister group relationship to each other by their synapomorphies, the 3rd segment of palpi more than 1/2 the length of 2nd segment (l_2) and the theca short with short membranous conjunctival lobe (zn_3) and outgroup relationship with the species of rest of the four genera by their synapomorphies like 3rd segment of palpi equal to half or less than half the length of second segment (l_1) and the theca large with large membranous conjunctival lobe (zn_2). Among first group *Euchalcia neostilpna* and *E. emichi* plays sister group relationships to each other by their synapomorphies like palpi antero-laterally directed (f_1), palpi with 3rd segment much shorter than 2nd segment (l_3), hind wings with two anal veins (u_1) and out-group relationship with *Euchalcia hedeja* by its autapomorphies like the palpi upturned and reaching vertex of head (f_2), the third segment of palpi slightly shorter than 2nd segment (l_4), the hind wings with three anal veins (u_3) and the papillae anales lunar-shaped (zb_9).

The second group comprises eleven species of the representatives of four genera falls into two sub-groups. The first sub-group includes four species of the genus *Allagrapha* plays sister group relationships to each other by their synapomorphies like the palpi with 3rd segment usually equal or longer than basal segment and sometimes basal segment much longer than second segment (j_1) and outgroup relationship with second group which comprises 7-species of the representatives of three genera by their synapomorphies like the basal segment of palpi always shorter than second (g_2) and the 3rd segment of palpi shorter than basal segment (j_2). Among first sub-group *Allagrapha aereoides, A. kashmiriensis* and *A. zubairi* plays sister group relationships with each other by their synapomorphies like the palpi with basal segment much shorter than 2nd and about equal to 3rd (g_3) and fore wings with anterior margin sinuated (o_1) and outgroup relationship with *Allagrapha aerea* by its autapomorphies like the palpi with basal segment much longer than 2nd and about 3X the length of 3rd segment (g_5), the fore wings with anterior margin sinuated (o_2), the hind wings with veins Rs originates just above upper angle of cell (w_4) and the corpus bursae simple with a ring-like cornuti (zf_2). Among former three species of the genus *Allagrapha*, the *A. kashmiriensis* and *A. zubairi* plays sister group relationship to each other by their synapomorphies like palpi with second segment less than 2X the length of basal segment (i_1), fore wings with 12-veins and veins R_3 and R_4 originating from cell (m_1), the papillae anales triangular-shaped (zb_2), the apophyses anteriors narrowed with apex pointed and shorter than apophyses posteriors (zc_2) and lobus vaginalis moderate (zd_1) and outgroup relationships with *Allagrapha aereoides* by its autapomorphies like the palpi with 2nd segment more than 2X the length of basal segment (i_2), the fore wings with 13-veins and veins R_4 and R_5 originating from cell (m_2), the apophyses anteriors broad, apex club-shaped much longer than apophyses posteriors (zc_6), lobus vaginalis large anteriarly broad (zd_2) and corpus bursae typical (zf_1).

Among rest of the 7-species of the representatives of three genera viz. *Diachrysia*, *Autographa* and *Megalographa*, the species of the genus *Diachrysia* plays sister group relationship to each other by their synapomorphies like the palpi with basal segmen about half the length of second segmen (g_4) and the paramere is much shorter than tegumen (zk_2) and outgroup relationships with rest of the four species viz. *Autographa gamma, A. argyrosigna, A. nigrisigna* and *Megalographa biloba* by their synapomorphies basal segmen of palpi about equal or slightly shorter than second segment (g_1) and the paramere much longer than tegumen (zk_1).

Among the species of the genus *Diachrysia*, the *D. rawlaensis* and *D. neostenochrysis* plays sister group relationship to each other by their synapomorphies like apical margin of fore wings crenulated (p_1), the tegumen elongated (zg_1) and uncus narrowed about equal to gnathos (zi_1) and outgroup relationships with *Diachrysia balluca* by its autapomorphies like apical margin of fore wings distinctly sinuated (p_2), the tegumen broad, pitcher-like (zg_2), the uncus thick much longer than gnathos (zi_2), the paramere very short with pointed apex (zl_4) and theca with three thecal appendages, the median and inner with dentition (zn_7). In rest of the species viz. *Autographa gamma, A. argyrosigna, A. nigrisigna* and *Megalographa biloba*, the last three species plays sister group relationships to each other in having the synapomorphies like frons anteriarly sub-roundly produced (d_1), the paramere with an inner median process directed posteriad (zm_3) and the membranous conjunctival lobe with a blunt thorn-like appendage at apex (zo_3), and outgroup relationship with *Autographa gamma* by its autapomorphies like frons anteriarly sub-acutely produced (d_5), the hind wings with only one anal vein (u_2), the paramere with inner median process directed anteriad (zm_6) and membranous conjunctival lobe with a sickle-shaped appendage (zo_9). In rest of the species the *Autographa nigrisigna* and *Megalographa biloba* plays sister group relationships to each other by their synapomorphies like fore wings with veins R_3 and R_4 wide apart (t_2), hind wings with veins Rs and M_1 anastomosing and originating from upper angle of cell (m_1) and both apophysesses are about equal in length (zc_1) and out-group relationship with *Autographa argyrosigna* with its autapomorphies like the fore wings with veins R_3 and R_4 stalked (t_4), the hind wings with veins Rs and M_1 wide apart and only M_1 originates from upper angle of cell (w_2), the uncus is lunar-shaped (zi_3) and the theca distally medially notched (zn_5).

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