REVISION OF THE GENUS *AUTOGRAPHA* HUBNER (LEPIDOPTERA: NOCTUIDAE: PLUSIINAE) FROM PAKISTAN WITH THEIR CLADISTIC RELATIONSHIP

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Abstract

In this study Genus *Autographa* Hubner is revised to accommodate three species, first time from Pakistan with reference to their head appendages, veins of fore wings, hind wings, male and female genitalia. A key to the species is formulated and the cladistic relationship is also briefly discussed.

Introduction

Hampson (1892) did not include the genus *Autographa* Hubner (1821), only the species *argyrosigna* Moore mentioned under the genus *Plusia*. Hashmi and Tashfeen (1992) in their check list "Lepidoptera of Pakistan" not mentioned above genus, including species only *nigrisigna*. Walker listed under the genus *Plusia*. Mahmood and Shah (1984) have considered the *Autographa* (=Plusia) *nigrisigna* (Walker) as a serious pest of cabbage and cauliflower and also studied the biology and generation period of the same species.

The work on various aspects of the genus *Autographa* were attempted by various worker viz. Peter and Larsen (1982), Klyuchko (1984), Neil (1984), Heinicke and Skworzow (1986), Matti and Waselius (1986), Kerppola and Mikkola (1987), Klyuchiko and Skvertsov (1987), Nils and Kallander (1987), Lafontaine (1987), Omkar and Shukla (1990), Ahola and Rytholm (1996), Nikolaevitch and Vjatchestavovna (2002) and Zahiri and Fibiger (2008). However the taxonomic work of above genus was neglected, therefore a taxonomic work of 3 species of this genus is presented in this paper.

Materials and Methods

The adult of the genus *Autographa* Hubner were collected from different fields e.g., Tomato (*Lycopersicum*), Cotton (*Gossypium hirsutum*), Wheat (*Triticum aestivum*), Potato (*Solanum tuberosum*) and Spinach (*Spinacia oleracea*) from Sindh, Punjab, K.P.K. (Khaber Pakhton Khua) and Azad Kashmir with the help of light trap. The adults were identified with the help of literature at hand and by Lasrio Ronkay Zoological Department, Hungarian Natural History Museum, Baross.

For the study of male and female genital complex, the routine procedures were attempted usually used by Kamaluddin and Fatima (1995) and Naz *et al.* (2007).

Results

Genus: *Autographa* Hubner 1821: *Autographa* Hubner, 1821, *Verz. Bek. Schmett*. (16): 251; Zahiri and Fibiger, (2008), *SHILAP, Revta, Lepid.* 36 (143): 301-339.

Diagnostic feature: Body generally dark brown with Y-shaped whitish tinged, head with frons produced sub-acute, vertex densely raised, palpi with basal segment shorter than 2nd, 3rd segment short, proboscis highly coiled, fore wings longer than hind wings, anterior margin sinuated, apical margin crenulated with apical angle sub- rounded, veins R_1 and R_2 largely stalked, only one anal vein present, hind wings with anterior margin convex, apical margin distinctly sinuated, veins Rs and M_1 anastomosing and originating from upper angle of cell, two anal veins (1A and 2A) present.

Genitalia: In males tegumen elongated uncus large, curve with apex acute, longer than gnathos, saccus tubular with anteriorly dilated, paramere large, narrowed, simple, aedeagus tubular with large theca, membranous conjunctiva moderate with thorn-like appendages. In females papillae anales somewhat quadrangular apophysesses well developed, usually equal in size, ductus bursae large tubular, corpus bursae balloon- shaped with or without cornuti.

Comparative note: This genus is most closely related to genus *Diachrysia* in having palpi with 3rd segment shorter than basal segment and basal always shorter than 2nd segment but it can easily be separated from the same in having palpi with basal segment about equal slightly shorter than 2nd segment, in males paramere much longer than tugumen and by the other characters as noted in the key and description.

Type species: *Phalaena gamma* (Linnaeus) 1758

Distribution: Palaearctic and Oriental regions.

Key to the species of the genus *Autographa* Hubner from Pakistan

1. Frons anteriarly sub-acutely produced, hind wings with only one anal vein, paramere with an inner-median process directed anteriad, membranous conjunctival lobe with a sickle-shaped appendage at apex…… ……...*Autographa gamma* Hubner
   Frons anteriarly sub- roundly produced, hind wings with two anal veins, paramere with an inner-median process directed posteriad, membranous conjunctival lobe with a blunt thorn-like appendage at apex……...2

2. Fore wings with veins R_3 and R_4 stalked, hind wings with veins Rs and M_1 wide apart, only M_1 originates from upper angle of cell, theca distally medially notched, uncus lunar-shaped…….*Autographa argyrosigna* Moore
   Fore wings with veins R_3 and R_4 wide apart, hind wings with veins Rs and M_1 anastomosing and originating from upper angle of cell, both apophysesses about equal in length ……*Autographa nigrisigna* Walker

***Autographa argyrosigna* Moore: (Figs. 1-7):** *Autographa argyrosigna* Moore, 1882, *Descr. Indian. Lep. Atkinson* (2): 149.

Sample: Two males, Naran Pakistan: on light, 14. 05. 2009, leg. Zubair Ahmad, lodged at Kamaluddin' s collection.

Colouration: Body generally brown, fore wings brown, except medially occupied by a brassy white Y-shaped lobe, hind wings brown, pale fuscous median and marginal area.

Wing expansion (Fig. 1): Body size 38 - 40mm with wing expansion.

Head (Fig. 2): Frons produced, sub convex anteriorly produced, palpi well developed, upturned, besets with scales, basal segment about $2/3^{rd}$ of the 2^{nd}, 3^{rd} segment shortest, about $1/3^{rd}$ of the 2^{nd} segment, proboscis short and coiled.

Fore wings (Fig. 3): Fore wings with anterior margin slightly sinuated, posterior margin sinuated, apical margin crenulated with apical angle sub-rounded, vein Sc widely separated and parallel to R_1 and R_2 largely stalked, R_3 and R_4 largely stalked, meeting with R_5 by a stalked later anastomosing with R_5 and originating from upper angle of cell, M_3 originates from lower angle of cell, Cu_1 and Cu_2 parallel to each other, only one anal vein (1A) present.

Hind wings (Fig. 4): Hind wings with anterior and posterior margin convex with apical margin distinctly sinuated**,** veins $Sc+R_1$ away from the costal margin and fused with Rs at base, Rs originates from just above upper angle of cell, M_1 originates from upper angle of cell, M_3 originates from lower angle of cell, Cu_1 and Cu_2 parallel to each other, two anal veins (1A and 2A) present.

Male genitalia (Figs. 5-7): Tegumen (Figs. 5 and 6) elongated and broad, saccus deeply U-shaped, distally broad with two small process, uncus highly curved with apex, gnathos large membranous, paramere large flipper-like with apex broad and truncated, outer margin sinuated, besets with large and small hair, a large thorn-like process and inner median margin, aedeagus (Fig. 7) with theca tubular, proximally dilated, distally large divided by a median groove, membranous conjunctival lobe large with a median rod-like and apical spear-shaped cornuti.,

Comparative note: This species is most closely related to *Autographa nigrisigna* in having frons anteriorly sub-roundly produced, paramere with an inner-median process directed posteriod but it can easily be separated from the same in having fore wings with veins R_3 and R_4 stalked, theca distally medially notched, uncus lunar- shaped and by the other characters as noted in the key and description.

Fig. 1

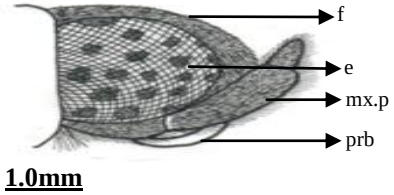

Fig. 2

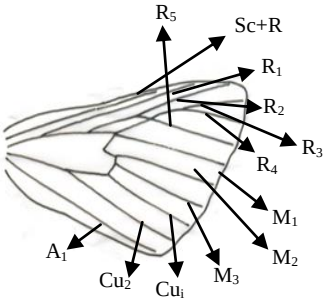

Fig. 3

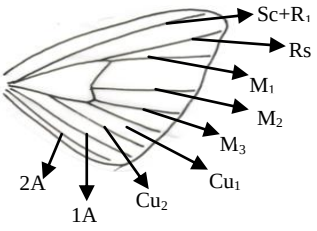

Fig. 4

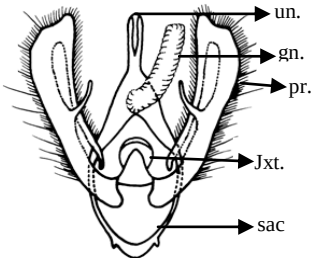

Fig. 5

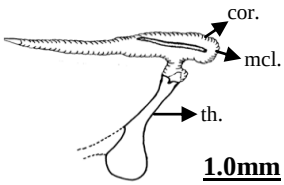

Fig. 6

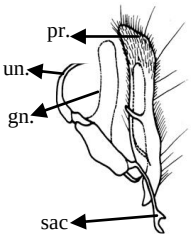

Fig. 7

Figs. 1-7. ***Autographa argyrosigna*** **Moore:**

1. Entire, dorsal view; 2. Head, lateral view; 3. Fore wing, dorsal view; 4. Hind wing, dorsal view; 5. Tegumen, ventral view; 6. Same, lateral view; 7. Aegeagus, lateral view.

Autograph gamma **Linnaeus (Figs. 8-14):** *Autographa gamma* (Linnaeus) 1758, Barou, 1967, *Entomolgie phytopath,appl.* 26: 1-12; Poole, 1989, *Lepidopterorum catalogues (New series), Fasc, 118*: 1314. Hacker, 1990, *Neue. Ent. Nachr.* 27: 1-707; Ebert and Hacker, 2002, *Esperiana. 9*: 237- 409; Goater *et al.* 2003. *Noctuidae Europaeae, Catacolinae* and *Plusiinae*. *10*: 452pp; Nikolaevitch and Vjatcheslavovna, 2002, *Phegea 30* (1): 11-36; Zahiri and Fibiger, 2008, *SHILAP, Revta, Lepid. 36* (143): 301-339.
Phalaena gamma (Linnaeus) 1758, *Syst. Nat. (End 10)* 1: 513.
Plusia gamma var. *gammina* Staudinger, 1901, In Staudinger and Rebel,*Cat. Lepid. Palaearct. Faunengeb*. *1*: 238.
Plusia gamma ab. alepica Nitsche, 1911, in Rebel, *Verh. Zool- bot. Ges. Wien. 61*: 52.

Sample: Two males, Naran, Pakistan: light, 18. 05. 2009, leg. Zubair Ahmad, lodged at Kamaluddin' s collection.

Colouration: Body generally dark brown, fore wings brown, except white mark medially occupied by a brassy white Y-shaped lobe, hind wings brown, pale fuscous median and marginal area.

Wing expansion (Fig. 8): Body size 38 - 40mm with wing expansion.

Head (Fig. 9): Frons produced, sub- acutely anteriorly produced, palpi well developed, besets with scales, basal segment about equal to the 2nd, later about 2X the 3rd segment, proboscis large and highly coiled.

Fore wings (Fig. 10): Fore wings with anterior margin slightly sinuated, posterior margin sinuated, apica margin crenulated with apical angle sub-rounded, veins Sc and R_1 parallel to each other, R_2 originates fro... above upper angle of cell, R_3 and R_4 anastomosing and originating from cell, R_5 originates from upper angle of cell, M_2 originates from lower angle of cell, Cu_1 and Cu_2 parallel to each other, only one anal vein (1A) present.

Hind wings (Fig. 11): Hind wings with anterior and posterior margin convex with apical margin distinctly sinuated**,** with apical angle sub-rounded, veins $Sc+R_1$ widely separated from Rs, Rs originates from upper angle of cell, M_1 originates just below upper angle of cell, M_3 originates from lower angle of cell, Cu_1 and Cu_2 parallel to each other, only one anal vein (1A) present.

Male genitalia (Figs. 12-14): Tegumen (Figs. 12 - 13) elongated, saccus V-shaped, proximally with a process at outer margin, without saccular process, uncus highly curved with apex beak-shaped, gnathos large, membranous, paramere large flipper-like with apex sub- acute , besets with large scattered hairs and small hairs, a large thorn- like process at inner median margin, aedeagus (Fig. 14), with theca tubular, proximally bulb-shaped, membranous conjunctival lobe large, proximally hood- like with bristles, distally large with a median and a distal thorn-like cornuti.

Comparative note: This species is most closely related to *Autographa argyrosigna* Moore in having palpi with basal segment about equal or slightly shorter than 2nd segment, in males paramere much longer than tegument, but it can easily be separated from the same in having frons anteriorly sub-acutely produced, hind wings with only one anal vein, paramere with an inner median process directed anteriad and by the other characters as noted in the key and description.

Fig.8

Fig.9

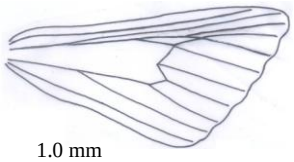

Fig.10

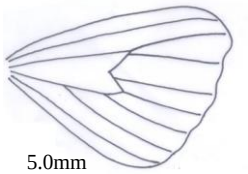

Fig.11

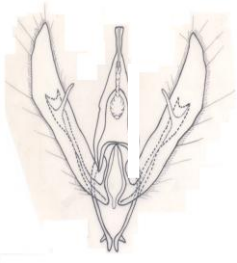

Fig. 12

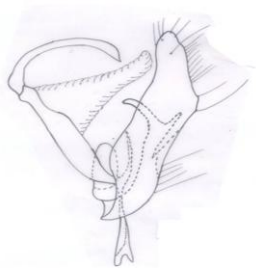

Fig.13

Fig.14

Fig. 8-14. *Autographa gamma* L.;

8. Entire, dorsal view; 9. Head, lateral view; 10. Fore wing, dorsal view; 11. Hind wing, dorsal view; 12. Tegumen, ventral view; 13. Same, lateral view; 14. Aegeagus, lateral view.

***Autographa nigrisigna* Walker: (Figs. 15-19):** *Autographa nigrisigna* Walker, 1858
Plusia nigrisigna Walker, 1858, *List. Spec. Lepid. Insects. Colln. Br. Mus.* 12: 928; 1857, *Cat. Lepi. Het.*12: 928; Butl, 1886, *111. Het.* 6: 2168.

Sample: Six females, Pakistan: Narran, on light, 10.6.1995, leg. Zubair Ahmad, Shakira, lodged at author' s collection.

Colouration: Body generally light to dark brown, fore wings brown, except white mark medially occupied by a brassy white lobe, hind wings pale fuscous median and marginal area.

Wing expansion (Fig. 15): Body size 34 - 36mm with wing expansion.

Head (Fig. 16): Frons broadly, sub-rounded, palpi well developed, large, besets with scales, basal segment shorter than 2nd, later about 3X the 3rd segment, proboscis large and highly coiled.

Fig.15

Fig.16

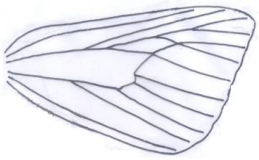

Fig.17

Fig.18

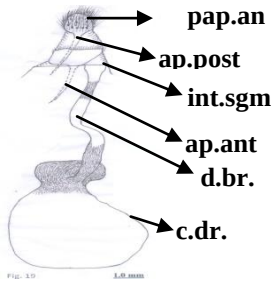

Fig.19

Figs. 15-19. ***Autographa nigrisigna*** **Walker:**

15. Entire, dorsal view; 16. Head, lateral view; 17. Fore wing, dorsal view; 18. Hind wing, dorsal view; 19. Female genitalia, lateral view.

Key to the letters: aed. (aedeagus), ap.ant. (apophysis anteriors), ant. (antenna), c.brs. (corpus bursae), d.brs (ductus bursae), e. (eye), f. (frons), gn. (gnathos), int.seg.m. (inter-segmental membrane), jxt. (juxta), max.p.(maxillary palp), pap.an. (papillae anales), pr. (paramere), sac. (saccus), teg. (tegumen), unc. (uncus), A1-A3. (first to third anal veins), Cu1- Cu2 (cubitus vein first to third), M1- M3.(median vein first to third), R1-R5 (radius vein first to fifth), Rs. (radio-suctorial vein), Sc. (sub-costal vein).

Fore wings (Fig. 17): Fore wings with anterior margin slightly sinuated, posterior margin sinuated, apical margin crenulated with apical angle sub- rounded, veins Sc and R_1 parallel to each other, R_2 and R_3 largely stalked, originated from above upper angle of cell, R_4 and R_5 anastomosing and originating from upper angle of cell, M_1 originates from below upper angle of cell, M_3 originates from lower angle of cell, Cu_1 and Cu_2 parallel to each other, only one anal vein (1A) present.

Hind wings (Fig. 18): Hind wings with anterior and posterior margin convex with apical margin distinctly sinuated**,** with apical angle sub-rounded, veins $Sc+R_1$ widely separated basally fused with Rs, veins Rs and M_1 originates from upper angle of cell, M_3 originates from lower angle of cell, Cu_1 originates just below of the lower angle of cell, two anal veins (1A and 2A) present.

Female genitalia (Fig. 19): Papillae anales well developed, somewhat oval-shaped, besets with thick scales, apophyses posteriors thorn-like, about equal to the length of apophyses anteriors, ductus bursae large, tubular, proximally delicate and distally narrowed, corpus bursae large bilobed bag-like without cornuti.

Comparative note: This species is most closely related to *Megalographa biloba* in having fore wings with veins R_3 and R_4 wide apart, both apophysesses about equal in length but it can easily be separated from the same in having fore wings with veins R_2 and R_3 stalked and originating from above upper angle of cell, ductus bursae medium sized and by the other characters as noted in the key and description.

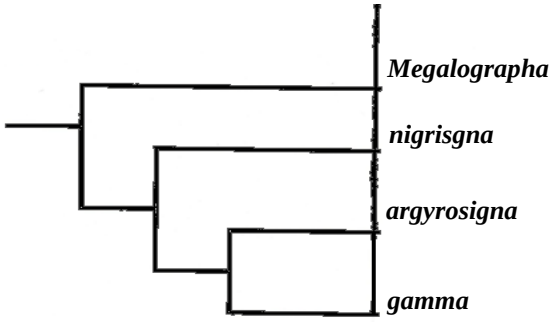

Fig. 20. Cladogram showing relationship of included taxa.

Discussion

The present cladogram (Fig. 20) showing the relationship of the species of the genus *Autographa* Hubner from Pakistan. This genus plays sister group relationships with *Megalographa* by their synapomorphies like palpi with basal segment about equal or slightly shorter than second segment and in males the paramere was much longer than tegumen and out-group relationships by its autapomorphies like fore wings with veins R_2 and R_3 parallel to each other and ductus bursae very large, convoluted and corpus bursae kidney shaped.

Among the species of the genus *Autographa* the species *A. nigrisigna* Walker played out-group relationship with *A. argyrosigna* Moore and *A. gamma* L., by its autapomorphies like second segment of maxillary palpi more than 4X the length of third segment, fore wings with veins R_2 and R_3 largely stalked, where as the *argyrosigna* and *gamma* plays sister group relationships with each other by their synapomorphies like second segment of palpi not more than 3X the length of third segment and fore wings with veins R_3 and R_4 largely stalked.

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