

Systematic Study of the Genus *Grapholita* Treitschke (Lepidoptera, Tortricidae) from Korea

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Seven species of the genus *Grapholita* Treitschke, 1829 are recognized from Korea. Among them, *G. funebrana* (Treitschke) and *G. sp. 1* are reported for the first time from Korea. The previously cited species with uncertainty of its distribution in the Korean peninsula, *G. inopinata* Heinrich, has not been found, and thus determined absent in the Republic of Korea. All the known species are redescribed with illustrations of adults, including genitalia of both sexes. Their known host plants are also listed. A key to the species of the genus, based on external and male genital characters, is given.

Genus *Grapholita* Treitschke, 1829 is a complex group belonging to the tribe Grapholitini of the subfamily Olethreutinae. The genus has a worldwide distribution, mostly in the Holarctic region, with more than 50 species from Palaearctic, 20 from Nearctic, and few from Oriental region (Razowski, 1989). Larvae commonly live in leaves of broad-leaved trees, but also live in stems, shoots, roots, and fruits. Some of them have been known as agricultural pests, e.g., *G. molesta* (Busk), Oriental Fruit Moth, attacks apple, cotoneaster, Japanese medlar, Christmas berry, almond, apricot, cherry, plum, peach, pear, rose, and etc. (Rothschild and Vickers, 1991), as an internal or external fruit feeder. Park (1983), for the first time, reviewed taxonomically the following five species of the genus from Korea, *G. scintillana* Christoph, *G. delineaana* Walker, *G. endrosias* (Meyrick), *G. molesta* (Busk) and *G. inopinata* Heinrich. However, he mentioned that *G. inopinata* had been cited only in the literatures to be distributed in Korea and thus the record of *G. inopinata* Heinrich was doubtful. The first citation of *G. inopinata* Heinrich in Korea was based on the map of fig. 52, on p. 96, Laspeyresinii (Tortricidae) by Danilevskii and Kuznetsov (1968), in which distributional range of *G. inopinata* was marked in the Far East from Transbaikalia to South of Primorye Territory including the northern board of Korean peninsula, indicating that the species had been known as one of the injurious pests of apple tree in North China and Korea. It clearly indicates the distributional range is restricted in the northern area of the Korean peninsula, and does not mean the Republic of Korea. In the recent publication,

"Quarantine Pests For Europe" prepared by C.A.B International and EPPO (European and Mediterranean Plant Protection Organization), the range of *G. inopinata* is indicated in Manchuria, Russian Far East (Primrye region, and as far west as Baikal, Tikhonov, 1962). Moreover, no specimen has been found from the field surveys during the last 20 years by researchers of ASTI, Rural Development Administration, Suweon. And also according to other previous survey reports on pests of top fruits in Korea (Nakayama and Okamoto, 1940; Park, 1977), no mention was for this species. Recently Shin et al. (1994) deleted *G. inopinata* in the recently published "Check List of Insects from Korea" for the south Korean fauna. For this reason, this study was initiated to survey for *G. inopinata* throughout the country, and confirmed again its absence in the Republic of Korea. An additional species, *G. dimorpha* Komai was reported by Park and Kim (1986). In the present review of the genus *Grapholita* in Korea, seven species were recognized on the basis of the materials preserved in the following institutions, and material collected during the last two years throughout the country.

Abbreviations for the collections and provincial names are as follows: ASTI-Agricultural Science and Technology Institute, Suweon; CIS-Center for Insect Systematics, Kangwon National University, Chuncheon; FRI-Forest Research Institute, Seoul; UIB-Department of Biology, University of Incheon, Incheon; GG-Gyeonggi; GW-Gangwon; CN-Chungnam; CB-Chungbuk; JN-Jeonnam; JB-Jeonbuk; GN-Gyeongnam; GB-Gyeongbuk; CJ-Jeju.

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Systematic Accounts

Grapholita Treitschke, 1829

Grapholitha Treitschke, 1829, Schmett. Eur. 7: 232.

Type species: *Tortrix lunulana* [Denis & Schiffermüller], 1775=*Pyralis dorsana* Fabricius, 1775.

Grapholitha Treitschke, 1830, ibid. 8: 203-nom. emend. for *Grapholitha* Treitschke, 1829.

Euspila Stephens, 1834, Ill. Br. Ent., *Haustellata* 4: 103. Type species: *Tinea compositella* Fabricius, 1775.

Aspila Stephens, 1834, ibid. 4: 104. Type species: *Pseudotomia Aspila lediana*: Stephens, 1834=*Coccyx janthinana* Duponchel, 1834.

Ephippiphora Duponchel, 1834, Annls Soc. ent. Fr. 3: 442. Type species: *Pyralis dorsana* Fabricius, 1775=*Tortrix lunulana* [Denis & Schiffermüller], 1775.

Opadia Guenée, 1845, ibid. (2) 3: 182. Type species: *Grapholita funebrana* Treitschke, 1835.

Stigmonota Guenée, 1845, ibid.: 182. Type species: *Tortrix lunulana* [Denis & Schiffermüller], 1775.

Endopisa Guenée, 1845, ibid.: 182. Type species: *Grapholita nebritana* Treitschke, 1830.

Coptoloma Lederer, 1859, Wein. Ent. Mschr. 3: 124, 370. Type species: *Coccyx janthinana* Duponchel, 1834.

Genera *Grapholita* and *Cydia* Hübner have been treated as closely related genera by Heinrich (1926), Obraztsov (1959), Danilevsky and Kuznetsov (1968), Razowski (1989) and Kawabe et al. (1992). However, Bradley et al. (1979), Leraut (1980), and etc. treated the genus *Grapholita* as a subgenus of *Cydia* without any discussion of their relationships. Larsen and Vihelmsen (1990) treated *Grapholita* as a synonym of *Cydia*. Recently, Razowski (1992) also treated *Grapholita* as a synonym of *Cydia* based on the analysis of characters of the scent organ and the female genitalia. However, Robinson, Tuck and Shaffer (1994) pointed out "*Cydia* is a dustbin genus, containing a large number of species which are not necessarily related and are badly in need of revision". The genus *Grapholita* can be separated from other related genera of the tribe Grapholitini by the combination of the following characters: Coremata well developed by two lateral clusters of long scales on membrane between abdominal segments VIII-IX in male; ductus bursae of female genitalia with well-sclerotized cingulum in form of angular plate or short conical structure.

Key to the Korean species of *Grapholita* Treitschke

1. Head ocherous; vertex suffused with dark gray.....2
- Head with vertex dark gray or black.....4
2. Dorsal blotch of forewing diffuse, scattered with pale brown.....*G. (A.) funebrana*

- Dorsal blotch of forewing distinct, consisting of two pairs of long striae.....3
3. Dorsal blotch of forewing consisting of thick striae*G. (G.)* sp. 1
- Dorsal blotch of forewing consisting of slender striae*G. (G.) delineana*
4. Forewing broad; sexual demographics present at hindwing.....5
- Forewing narrow; sexual dimorphism absent at hindwing.....6
5. Hindwing of female concave at lower termen.....*G. (A.) dimorpha*
- Hindwing of female with large, gray ocherous patch*G. (A.) molesta*
6. Forewing with ocelloid patch.....*G. (G.) scintillana*
- Forewing without ocelloid patch.....*G. (G.) endrosias*

Key to the Korean species of *Grapholita* Treitschke based on the male genitalic character

1. Cornuti non- or ill-deciduous type.....Subgenus *Grapholita* Treitschke. 2
- Cornuti deciduous type.....Subgenus *Aspila* Stephens. 5
2. Tegumen broad and apically well-sclerotized, with a lobe at anterior top.....*G. (G.) scintillana*
- Tegumen narrow and apically membranous, without such lobe at anterior top.....3
3. Aedeagus long (about 0.9 times as long as valva), weak membranous.....*G. (G.) endrosias*
- Aedeagus short (0.5-0.7 times as long as valva), sclerotized.....4
4. Aedeagus pistol-like (abruptly narrow from apical half).....*G. (G.) delineana*
- Aedeagus rather short funnel (gradually narrow apically).....*G. (G.)* sp. 1
5. Cucullus clavated; sacculus with a process at lower edge.....*G. (A.) funebrana*
- Cucullus spatulated; sacculus without such process6
6. Valva almost straight at costal side.....*G. (A.) molesta*
- Valva gently curved at costal side.....*G. (A.) dimorpha*

Grapholita (Grapholita) scintillana Christoph¹
(Figs. 1, 10, 17)

Grapholita scintillana Christoph, 1881, Bull. Soc. Imp. Nat. Moscou. 56: 421, (Type locality: Vladivostok, Russia); Kennel, 1921: 665; Danilevsky & Kuznetsov, 1968: 278-280, figs. 161, 163; Kuznetsov, 1969: 44; Kawabe, 1982: 1: 145, 2: 179, pl. 30, fig. 4; Park,

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1983: 670, 966, fig. 342, pl. 43, fig. 751.

Laspeyresia scintillana: Kennel, 1921: 665, pl. 24, fig. 19.

Euspila scintillana: Issiki, 1957: 54, Pl. 8, fig. 242.

Grapholita (Euspila) scintillana: Obraztsov, 1959: 211, 215, fig. 63, pl. 26-3.

Grapholita scintillana elegantana Kuznetsov, 1968: 279-280.

Adult: Wing expanse, ♂ 10 mm (Fig. 1), ♀ 11 mm. Head dark gray. Antenna blackish gray, with whitish annulations. Labial palpus yellowish white; terminal segment suffused with dark gray. Thorax with tegula shining dark gray. Abdomen dark fuscous. Forewing narrow; ground color dark gray, darker costally; fasciate markings dark brown; basal and sub-basal fasciate usually confluent, its outer edge indistinctly and strongly angulated medially; median fascia indistinctly developed, slender, irregularly with blackish dots; costa with five pairs of whitish strigulae from apex to basal 1/4, inner two pairs strigulae slender, oblique and diffuse, and bearing with three leaden striae inwards; dorsal blotch indistinct rhomboid, from middle of dorsum consisting of two pairs of slender, whitish streaks; ocelloid patch comprising four or five black dots, with two plumbeous streaks on inner and outer margin; cilia dark gray, with a blackish subbasal line interrupted by whitish spot below apex. Hindwing dark brownish gray; cilia pale gray, with a dark subbasal line.

Male genitalia (Fig. 10): Tegumen slender, broad and well-sclerotized apically, with a lobe at anterior apex.

Valva rather concave medially; cucullus rather long, spatulate, bearing with stout spines along lower margin; sacculus with thickened short lobe at ventral margin. Aedeagus short and broad; cornuti consisting of a sheaf with modified long spines.

Female genitalia (Fig. 17): Papillae anales slender. Sterigma membranous. Ostium broad cup-shaped. Ductus bursae short, strongly sclerotized near corpus bursae, with a rounded concave portion dorso-laterally. Corpus bursae large, ovate, with two horn-shaped signa, sclerotized at base. Ductus seminalis broader than ductus bursae, originating from conjunction of ductus bursae and corpus bursae.

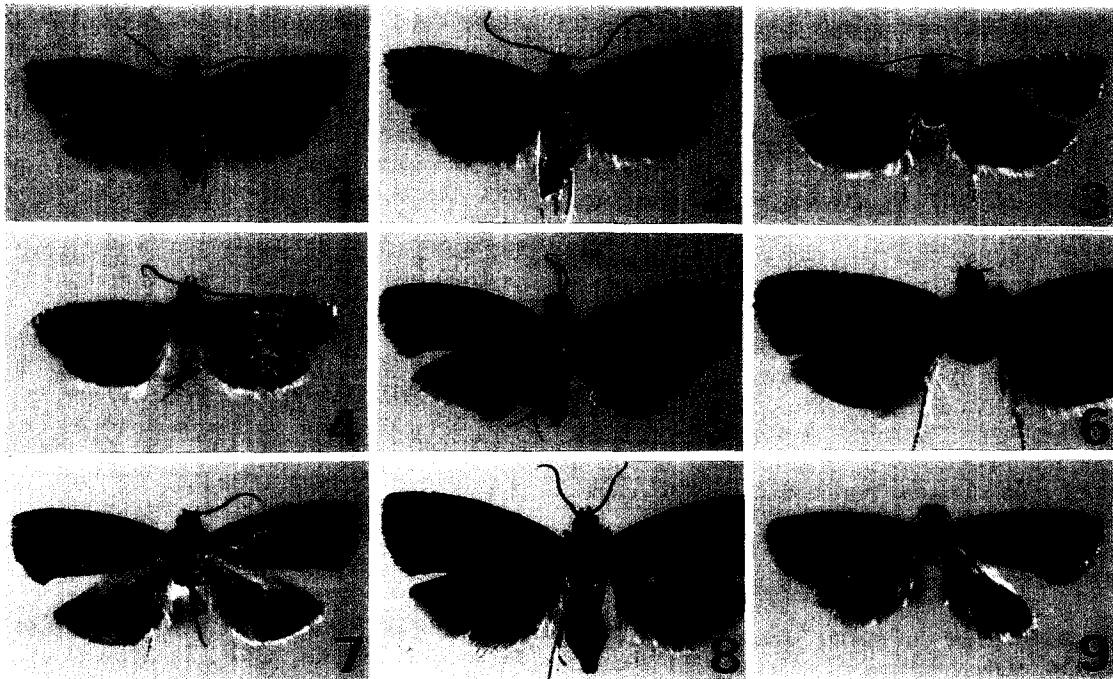
Material examined: [GG]- 1 ♀, Mt. Cheonggye, 19, VIII. 1976 (K. T. Park), ASTI; 8 ♂, 2 ♀, Suweon, 13-14. IV, 1977 (K. T. Park), ASTI; 1 ♂, 1 ♀, same data, CIS, gen. sl. no. UIB-042, UIB-071; 1 ♂, 2 ♀, Suweon, 20. IV. 1977 (M. O. Yum & Y. Y. Ha), ASTI; 1 ♂, Suweon, 13. IV. 1977 (K. T. Park), CIS, gen. sl. no. 1116; 1 ♂, Suweon, 20. V. 1977 (Y. Y. Ha), CIS, gen. sl. no. UIB-067; 1 ♀, Suweon, 8. V. 1977 (K. T. Park); 1 ♂, Suweon, 4. IV. 1989 (S. B. Ahn), ASTI.

Flight period: April to May and August.

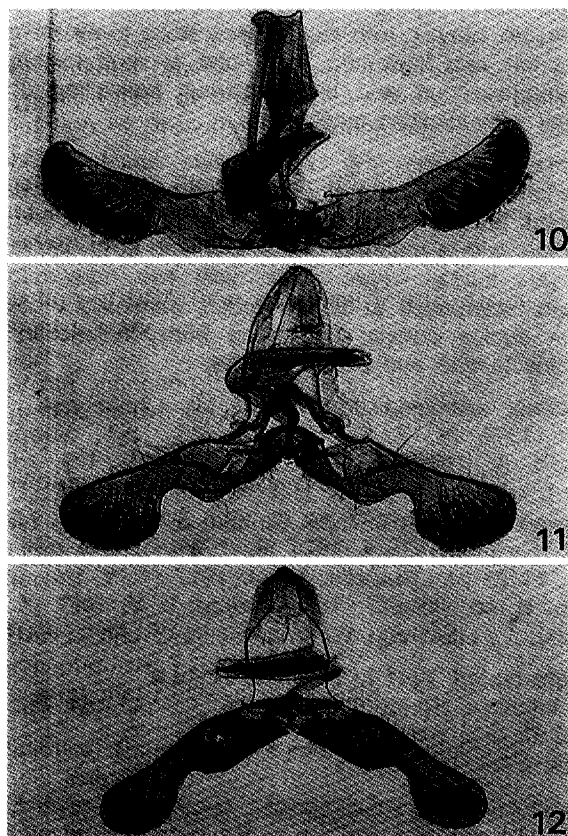
Distribution: Korea (GG), Japan, China, and Russia (SE Siberia, Amur).

Host plant: Unknown.

Diagnosis: This small species superficially resembles *G. delineana*, but can be easily distinguished by the narrower forewing, with indistinct dorsal blotch.



Figs. 1-9. *Grapholita* spp., adults: 1. *G. (G) scintillana* Christoph, ♂; 2. *G. (G) delineana* Walker, ♂; 3. *G. (G) sp. 1*, ♂; 4. *G. (G) endrosias* (Meyrick), ♂; 5. *G. (A) dimorpha* Komai, ♂; 6. ditto, ♀; 7. *G. (A) molesta* (Busk), ♂; 8. ditto, ♀; 9. *G. (A) funebrana* (Treitschke), ♂.



Figs. 10-12. *Grapholita* spp., Male genitalia: 10. *G. (G) scintillana* Christoph; 11. *G. (G) delineana* Walker; 12. *G. (G) sp. 1*.

Grapholita (Grapholita) delineana Walker¹
(Figs. 2, 11, 18)

Grapholita delineana Walker, 1863, List Spec. Lep. Ins. Br. Mus. 28: 389, (Type locality: Europe); Issiki, 1950: 479, fig. 1301; 1957: 54, pl. 8, fig. 244; Inoue, 1954: 93; Oku, 1967: 56; Danilevsky & Kuznetsov, 1968: 261-263, figs. 141b, 145, 146; Yasuda, 1969: 86, pl. 42, fig. 166; Kor. Soc. Pl. Prot. 1972: 136; Liu & Bai, 1977: 42, pls. 6-24, 12-59, 20-59; Kuznetsov, 1978: 615, figs. 179-1, 192-1, 2, 529-3, 4; Park, 1983: 669, 966, pl. 43, fig. 750.

Grapholita epicapta Walker, 1863, *ibid.*: 390.

Grapholita mundana Christoph, 1881, Bull. Soc. Nat. Moscou 56: 420; Danilevsky & Kuznetsov, 1968: 261-263, fig. 141a.

Laspeyresia quadristriana Walsingham, 1900, Ann. Mag. Nat. Hist. (7) 6: 432.

Laspeyresia isacma Meyrick, 1907: 144.

Laspeyresia mundana: Kennel, 1921: 644, pl. 24, fig. 18.

Grapholita (Grapholita) delineana: Razowski, 1991: 18-19, figs. 14, 104.

Grapholita quadristriana: Kawabe, 1982, 1: 179, 2: 145, pl. 30, fig. 2; Kawabe & Komai, 1992: 108.

Cydia delineana: Karsholt & Razowski, 1996: no. 5084.

Adult: Wing expanse, ♂ 9.5-12 mm (Fig. 2), ♀ 10-14.5 mm. One of the most common species, which is easily collected on hemp from May to September in Korea. It is well known as a pest of hemp and hop. Larvae bore into the stem and makes galls.

Male genitalia (Fig. 11): Tegumen weakly developed. Valva short, rectangular at base, strongly concave at lower half; cucullus spatulate, bearing stout spines along lower margin, and with rounded terminally; sacculus well sclerotized, with thickened short lobe at ventral margin. Aedeagus moderate in size, 0.7 times as long as valva, pistol-like, abruptly narrow from apical half; cornuti consisting a sheaf with about six long scale-like spines and many stout spines.

Female genitalia (Fig. 18): Papillae anales slender. Sterigma subquadrate. Ostium bursae broad, funnel-like. Ductus bursae moderate in size, anterior half broad, widely sclerotized about middle. Corpus bursae large, ovate, with two different shaped signa; ventral one broad plate, and dorsal one horn-shaped. Ductus seminalis broader than ductus bursae, originating before sclerotized part of ductus bursae. Seventh sternite with two large round sclerites at antero-lateral side.

Material examined: [GW]- 1 ♂, Hongcheon, 10. Vi. 1988 (K. T. Park), CIS; 1 ♂, Seomyun, Yangyang, 10. Vi. 1971 (K. T. Park), CIS, gen. sl. no. UIB-124; 1 ♂, same data, except on 10. VII. 1987; 1 ♀, Mt. Jeombong, 22. Vi. 1992 (K. T. Park); 1 ♂, 1 ♀, Munmag-ri, Wonju, 13. VII. 1990 (S. W. Cho), CIS; 1 ♀, Chuncheon, 22. V. 1985 (K. T. Park), CIS, gen. sl. no. 1471; 1 ♂, Chuncheon, 4. Vi. 1989 (K. T. Park & B. K. Byun), CIS; 4 ♀, Chuncheon, 13. V. 1989 (B. K. Byun), CIS, gen. sl. no. 3422, UIB-125; 2 ♂, Chuncheon, 2. VII. 1989 (B. K. Byun), CIS; 1 ♂, Chuncheon, 12. Vi. 1990 (K. T. Park & B. K. Byun), CIS, [GG]-1 ♂, Mt. Kwangduk, 20. VIII. 1996 (Bae et al.), UIB; 1 ♂, Mt. Paekun, 9. IX. 1989 (S. H. Lee), ASTI; 1 ♂, Mt. Myungji, 27. VI. 1983 (K. T. Park), CIS; 1 ♂, 1 ♀, Gwangleung, 7. VIII. 1986 (K. T. Park & M. K. Ko), CIS; 1 ♀, Gwangleung, 8. VII. 1992 (K. T. Park), CIS, gen. sl. no. 3421; 9 ♂, 2 ♀, Mt. Soyo, 7. VII. 1986 (Bae, Paek, Lee & Ahn), UIB, gen. sl. no. 126; 1 ♂, Mt. Cheonma, 13. VII. 1996 (Y. S. Bae), UIB; 15 ♂, 8 ♀, Mt. Cheonma, 3. IX. 1996 (Y. S. Bae & M. K. Paek), UIB; 2 ♀, Ipo-ri, Yeosu, 20. VIII. 1990 (S. W. Cho), CIS; 1 ♂, 2 ♀, Mulwang reser., 24. VIII. 1996 (M. K. Paek), UIB; 2 ♂, Backryung Is., 22. VIII. 1995 (M. S. Go), CIS; 3 ♂, 2 ♀, Bukri, Deokjeok Is., 16. IX. 1995 (Bae et al.), UIB, gen. sl. no. UIB-069. [CN]- 1 ♀, Chupungreng, 30. VIII. 1996 (M. K. Paek), UIB, gen. sl. no. UIB-127. [JB]- 1 ♀, Mt. Naebang, 4-5. VIII. 1992 (K. T. Park & B. K. Byun), CIS. [JN]- 1 ♀, Mt. Jiri, 14. VII. 1976 (Y. Y. Ha), CIS.

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Flight period: May to June and July to September.

Distribution: Korea (GW, GG, GB, CN, JB, JN), Japan, China, Russia, Europe, Taiwan, Assam, New Guinea, and Iran.

Host plants: Korea: *Humulus japonicus* Sieb. et Zucc., *Humulus lupulus* L., *Cannabis sativa* L. (Cannabinaceae) (Park, 1983). Larvae of this species seriously damage to stems and seeds of *H. japonicus* Sieb. et Zucc. in Korea.

Diagnosis: This species is very closely allied and similar to following species, *G. sp. 1.*, but can be separated by having narrower dorsal blotch than that of the latter. The discriminating characters are discussed under following species.

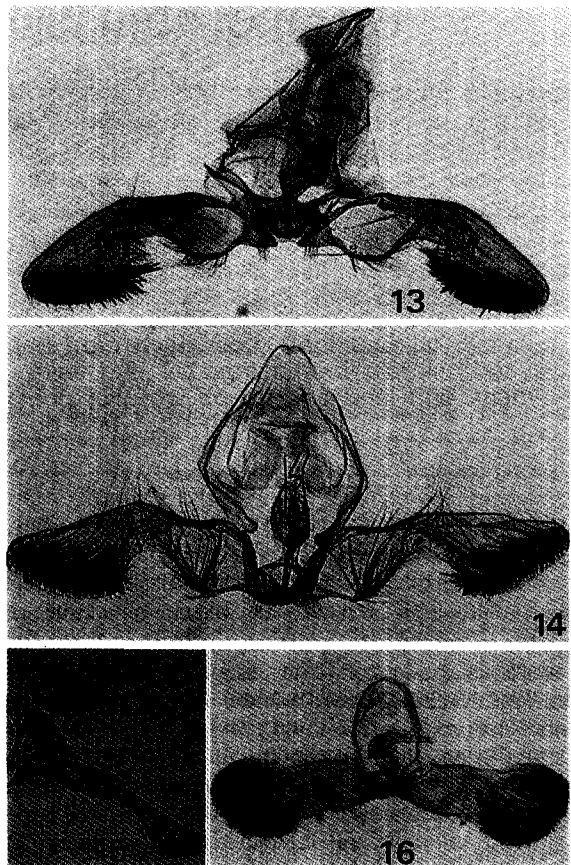
*Grapholita (Grapholita) sp. 1**
(Figs. 3, 12, 19)

Adult: Wing expanse, 11-12 mm (Fig. 3). No sexual difference in wing maculation. Head ochreous; vertex mixed with dark gray. Antenna grayish fuscous. Labial palpus pale ochreous; terminal segment sharply pointed. Thorax with tegula umber brown. Abdomen dark brown. Forewing narrow in male, broad in female; ground color fuscous brown, basal area paler, concolorous with thorax; costa with eight well-defined yellowish strigulae from apex to basal 1/4, basal two strigulae strongly oblique, rather narrow, and bearing with three leaden striae inwards; a slender fuscous transverse streak present on median cell; dorsal blotch quadrate, from middle of dorsum consisting of two pairs of thick, orangeish streaks, the basal one being surmounted by a plumbeous dash; ocelloid patch represented by a thick, violet leaden streak arising from tornus; cilia gray, with a blackish basal line interrupted by whitish spot below apex. Hindwing dark grayish brown, paler basally; cilia pale grayish ocher, with a dark subbasal line.

Male genitalia (Fig. 12): Tegumen weakly developed, protruded post-apically. Valva short, rectangular at base, strongly concave at lower half; cucullus round spatulate, bearing stout spines inwards; sacculus well sclerotized. Aedeagus rather short, 0.5 times as long as valva, gradually narrow apically; cornuti consisting a sheaf with many long scale-like spines.

Female genitalia (Fig. 19): Papillae anales narrow, broad posteriorly. Sterigma weakly developed. Ostium bursae funnel-like. Ductus bursae long, about same length of VII sternite, moderately sclerotized. Corpus bursae relatively small, strongly sclerotized at lateral side, with two blade-shaped signa. Ductus seminalis broad, originating from conjunction of ductus bursae and corpus bursae.

Material examined: [GW]- 2♂, Pyungchang, 31. VII. 1991 (K. T. Park), gen sl. no. UIB-114, CIS. [GG]- 2



Figs. 13-15. *Grapholita* spp., Male genitalia: 13. *G. (A) dimorpha* Komai; 14. *G. (A) molesta* (Busk); 15. *G. (G) endrosias* (Meyrick); 16. *G. (A) funebrana* (Treitschke).

♀, Mt. Cheonggye, 19. VIII. 1976 (K. T. Park), Gen. sl. no. UIB-070, CIS. [JB]- 1♀, Muju, 13. VIII. 1975 (K. T. Park), ASTI.

Flight period: June to August.

Distribution: Korea (GW, GG, JB), Mongolia, Russia, and Europe to Asia Minor.

Host plants: Korea: unknown. Europe: *Trifolium pratense*, *T. repens*, *Medicago sativa*, *Melilotus*, *Lotus corniculatus* (Leguminosae) (Bradley, et al., 1979).

Diagnosis: Forewing pattern of this species is very similar to that of *G. delineana*, but can be separated by the following characters: dorsal blotch consisting of two pairs of broad orangeish streaks, the basal one being surmounted by a plumbeous dash. In the genitalia, aedeagus rather short funnel-like and corpus bursae strongly sclerotized laterally, while in *delineana*, the dorsal blotch consisting of narrower, pale orangeish or whitish streaks, the aedeagus pistol-like, the corpus bursae membranous, with two different shaped signa. The species is reported for the first time from Korea. This species was described by Komai (1982) in the doctoral thesis of University of Osaka Prefecture, Japan, and will be published soon with scientific name.

* 큰네줄애기잎말이나방 (新稱)

Grapholita (Grapholita) endrosias (Meyrick)*
(Figs. 4, 15)

Laspeyresia endrosias Meyrick, 1907, J. Bombay Nat. Hist. Soc. 18: 145, (Type Locality: Khasi Hills, Assam); Clarke, 1958: 36, pl. 217, figs. 3, 3a.

Euspila endrosias: Issiki, 1957: 54, pl. 8, fig. 243.

Grapholita (Euspila) endrosias: Obraztsov, 1959: 211; 1967: 26; Kawabe, 1982, 1: 145, 2: 179, pl. 30, fig. 5.

Grapholita endrosias: Danilevsky & Kuznetsov, 1968: 608-609, fig. 463; Park, 1983: 670, 966.

Adult: Wing expanse, ♂ 11 mm (Fig. 4). Head and thorax black, scattered with creamy white. Antenna black, with whitish annulations. Labial palpus whitish gray; terminal segment rather long, mixed with black. Forewing narrow; termen elongate; ground color dark fuscous, darker costally, and suffused with reddish orange on apical 1/3; basal and sub-basal fasciae confluent, irrorated with creamy white; median fascia indistinctly developed, slender, irregularly with blackish dots; costa with well-defined three yellowish white strigulae on apex, and indistinctly with four or five pairs of whitish strigulae from apex to basal 1/4, and bearing with two slender metallic leaden striae inwards; dorsal blotch area scattered with creamy white scales; ocelloid patch absent; cilia dark gray, with a blackish subbasal line concave below apex. Hindwing dark fuscous; cilia pale grayish ochre, with a dark subbasal line.

Male genitalia (Fig. 15): Tegumen weak and narrow. Valva slender, slightly narrowed medially; cucullus spatulate, bearing stout spines along the lower margin; sacculus narrow. Aedeagus long, about 0.9 times as long as valva, broad and weak membranous.

Female genitalia: Unknown in Korea.

Material examined: [GG]- 1 ♂, Mt. Myungji, 25. V. 1990 (K. T. Park), CIS, gen. sl. no. 3429.

Flight period: Late May.

Distribution: Korea (GG), Japan, Russia (Kuril Is., and India (Assam).

Host plant: Unknown.

Diagnosis: Unfortunately we could not find additional specimens of this species from Korea after the report by Park (1983). This species differs from the known species of the genus by the forewing suffused with reddish orange apically, and absence of the dorsal blotch and ocelloid patch. The male genitalia of this species are very characteristics as mentioned above.

Grapholita (Aspila) dimorpha Komai¹
(Figs. 5-6, 13, 20-21)

Grapholita dimorpha Komai, 1979, Appl. Ent. Zool. 14:

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¹ 복숭아순나방붙이

133, figs. 1, 2, 4, 6, (Type Locality: Honshu, Japan); Kawabe, 1982, 1: 146, 2: 179, pl. 30, figs. 12-13, pl. 287, fig. 8, pl. 293, fig. 12; Park & Kim, 1986: 82, fig. 3-3.

Adult: Wing expanse, ♂ 10-11.5 mm, ♀ 12-14.5 mm (Figs. 5-6). For a description, see to the original description by Komai (1979).

Male genitalia (Fig. 13): Tegumen broad, with pointed top. Valva narrow, strongly concave at lower middle, costal side gently curved; cucullus spatulate, rather broad and rounded terminally, bearing stout spines along lower margin; sacculus narrow, weakly developed. Aedeagus broad basally, curved; cornuti with a series of filiform thorns.

Female genitalia (Figs. 20-21): Similar to those of *G. molesta*, but this species is can be distinguished by the strongly concave sterigma at anterior margin.

Material examined: [GW]- 1 ♀, Chuncheon, 7. V. 1989 (K. T. Park), CIS, gen. sl. no. 3437; 1 ♂, same data, 25. VI. 1985, gen. sl. no. 1498; 1 ♀, same data, 9. IX. 1988; 1 ♀, same data, 7. VI. 1990, gen. sl. no. 3424; 7 ♂, Chuncheon, 12-13. VI. 1989 (K. T. Park & B. K. Byun), CIS, gen. sl. no. 3425, 3430; 1 ♂, Choogok-ri, Chuncheon, 2. IX. 1996 (H. K. Lee & J. S. Lee), CIS; 1 ♂, Mt. Seolak, 10. VIII. 1990 (K. T. Park), CIS; 1 ♂, Mt. Seolak, 20. VIII. 1989 (K. T. Park & B. K. Byun), CIS, gen. sl. no. 3341; 1 ♂, Mt. Samak, 19. VII. 1990 (S. W. Cho), CIS; 1 ♂, Mt. Jeombong, 28. VIII. 1995 (Y. S. Bae), UIB, gen. sl. no. UIB-066; 1 ♀, chuncheon-Dam, 12. VIII. 1991 (K. T. Park), CIS, gen. sl. no. 2986; 7 ♂, 1 ♀, Hwengsung-Dam, 22. VIII. 1994 (B. K. Byun), ASTI; 1 ♂, Hwacheon, 2. VII. 1985 (K. T. Park), CIS; 1 ♂, Jungseon, 23. VII. 1996 (J. S. Lee), CIS. [GG]- 1 ♂, Mt. Cheonma, Namyangju, 13. VII. 1996 (Y. S. Bae), UIB.

Flight period: May and July to September.

Distribution: Korea (GW, GG) and Japan.

Host plants: Korea: Unknown. Japan: *Prunus salicina* Lindley and *Chaenomeles speciosa* (Sweet) Nakai (Rosaceae) (Komai, 1979).

Diagnosis: This species had been confused with *G. molesta* until Komai (1979) provided clear description. The wing pattern and genital structures of both sexes are very similar to each other, but *dimorpha* can be distinguished from *molesta* by the following characteristics: male hindwing rather convex at tornal area; slightly arched costa of valva in male genitalia; VII sternite with convex caudal margin.

Grapholita (Aspila) molesta (Busk)²
(Figs. 7-8, 14, 22)

Laspeyresia molesta Busk, 1916, J. Agr. Res. U. S. Dept. Agr. 7: 373, (Type locality: Ohara, Japan);

² 복숭아순나방

Meyrick, 1928: 590.

Grapholitha molesta: Heinrich, 1926: 28-29, pl. 22, fig. 129, pl. 50, fig. 305; Issiki, 1957: 55-56, fig. 33, pl. 8, fig. 247; Inoue, 1954: 93; Oku, 1967: 56-57; Yasuda, 1969: 86, pl. 42, fig. 167; Komai, 1976: 246, figs. 2, 9, 15; Liu & Bai, 1977: 44, pls. 7-3, 12-62, 20-62.

Grapholitha (Grapholitha) molesta: Obratzov, 1959: 208, 213, pl. 25, fig. 4; Hannemann, 1961: 98-99, fig. 186, pl. 6, fig. 30.

Grapholitha (Grapholitha) molesta: Bradley, 1959: 70, fig. 4a, pl. 4, fig. 37.

Grapholitha molesta: MacKay, 1959: 70, fig. 54; Bradley, 1959: 65, fig. 3a, pl. 4, fig. 37; Baker, 1963: 212; Zool. Soc. Kor. 1968, Nom. Amim. Korea 2: 46; For. Res. Inst. 1969, List For. Ins. Pests, Korea: 86; Kor. Jour. Pl. Prot. 16: 36; Backer & Cardé, 1979: 173-188; Komai, 1979: 134, figs. 3, 5, 7; Kawabe, 1982: 1: 146, 2: 179, pl. 30, fig. 10; Park, 1983: 667-668, 965, pl. 43, fig. 748.

Grapholitha (Aspila) molesta: Danilevsky & Kuznetsov, 1968: 321-325, figs. 198, 199, 201; Kuznetsov, 1978: 602, 604, fig. 515-6, 516-2, 520-1.

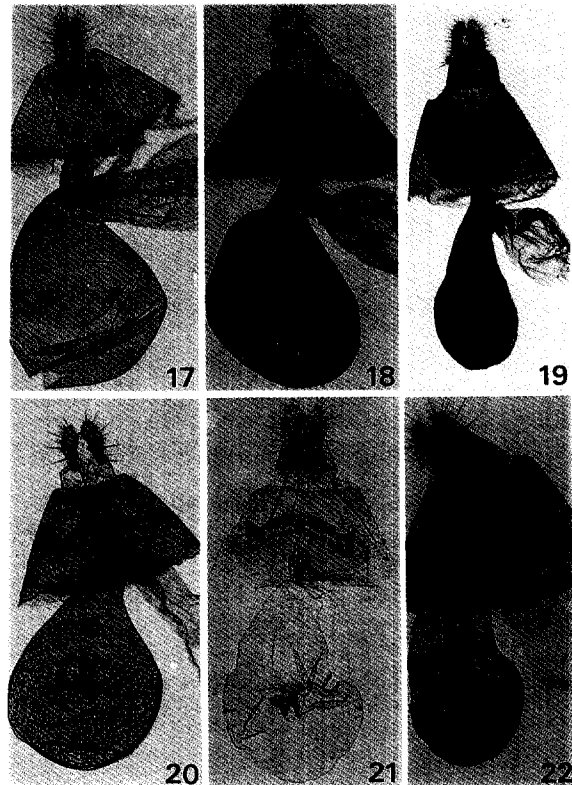
Cydia molesta: Bradley, Tremewan & Smith, 1979: 250-251, pl. 40, fig. 24; Karsholt & Razowski, 1996: no. 5107.

Adult: Wing expanse, ♂ 11-12, ♀ 12-14.5 mm (Figs. 7-8). For wing description, see Bradley, Tremewan, and Smith (1979).

Male genitalia (Fig. 14): Tegumen broad, with pointed and slightly bifid top. Valva narrow, strongly concave at lower middle, the costal side almost straight; cucullus spatulate, rather broad and rounded terminally, bearing stout spines along lower margin; sacculus narrow, weakly developed. Aedeagus curved, broader basally; cornuti consisting of a series of filiform thorns.

Female genitalia (Fig. 22): Papillae anales broad, narrower anteriorly. Sterigma large, variable in size, well-sclerotized, with two projection post-laterally, anterior margin almost straight. Ostium bursae small. Ductus bursae short, 0.4 times as long as corpus bursae, with large, modified sclerites behind corpus bursae. Corpus bursae large, with two horn-shaped signa. Ductus seminalis weak membranous, broad, originating from conjunction of ductus bursae and corpus bursae. Posterior edge of VII sternite almost straight.

Material examined: [GW]- 1 ♂, Chuncheon, 20. VI. 1983 (K. T. Park), CIS; 1 ♂, same data, 21. VI. 1985, gen. sl. no. 1464. [GG]- 1 ♀, Gwangleung, 8. VI. 1977 (J. S. Lee), ASTI; 1 ♀, Suweon, 26. VIII. 1974 (K. T. Park), CIS; 1 ♀, Suweon, 5. VIII. 1975 (H. K. Kim), ASTI, from *Pyrus ussuriensis* var. *macrostipes*; 1 ♂, Suweon, 2. VII. 1978 (K. T. Park), ASTI, gen. sl. no. UIB-073; 1 ♀, Suweon, 3. VIII. 1982 (W. S. Cho), CIS, gen. sl. no. 3428; 2 ♀, Suweon, 19. VII. 1982 (S. W. Lee), ASTI, ex. *Prunus persica*; 1 ♀, Suweon, 3. VIII. 1982 (S. C. Han), ASTI, ex. seed of *Solanum tuberosum*



Figs. 17-22. *Grapholitha* spp., female genitalia: 17. *G. (G) scintillana* Christoph; 18. *G. (G) delineana* Walker; 19. *G. (G)* sp. 1; 20. *G. (A) dimorpha* Komai; 21. ditto; 22. *G. (A) molesta* (Busk).

sum; 1 ♂, Suweon, 19. IV. 1983 (K. Chung), ASTI, ex. *Malus pumila* var. *dulcissima*; 1 ♂, 1 ♀, Suweon, 26-28. VII. 1984 (S. B. Ahn), ASTI, ex. fruit and leaves of *Malus pumila* var. *dulcissima*; 1 ♀, Hwanseong, 28. VII. 1982 (S. C. Han), ASTI, ex. *Pyrus ussuriensis* var. *macrostipes*; 2 ♂, 1 ♀, Yeoncheon, 8. IX. 1984 (D. J. Im), ASTI, ex. *Chaenomeles sinensis*. [JN]- 1 ♂, 1 ♀, Naju, 27. IX. 1985 (S. B. Ahn), ASTI, ex. *Chaenomeles sinensis*; 1 ♀, Jungsan-ri, Mt. Jiri, em. 2. IX. 1996 (Y. S. Bae, M. K. Paek & B. W. Lee), UIB, ex. *Chaenomeles sinensis*.

Flight Period: April, June to July and August to September.

Distribution: Korea (GW, GG, JN), Japan, China, Europe, N. America, and Australia.

Host plants: Korea: *Prunus persica* B., *P. serrulata* var. *spontanea* W., *P. salicina* L., *P. mume* Sieb. et Zucc., *P. armeniaca* var. *ansu* K., *Pyrus ussuriensis* var. *macrostipes* (Nakai) T. Lee, *Eriobotrya japonica* L., *Crataegus* sp. (Rosaceae) and *Diospyros kaki* T. (Ebenaceae) (Park, 1983). New record: Larvae also demagee fruits of *Chaenomeles sinensis* Koehne and seeds of *Solanum tuberosum* L. (Solanaceae).

Diagnosis: This species is very similar to *G. dimorpha*, but can be distinguished by the following characteristics: male hindwing with grayish ocher androconial patch;

rather straight costa of valva in male genitalia; VII sternite with almost straight caudal margin.

Grapholita (Aspila) funebrana (Treitschke, 1835)*
(Figs. 9, 16)

Grapholita funebrana Treitschke, 1835, Schmett. Eur. 10(2): 116, (Type locality: Europe); Pierce & Metcalfe, 1922: 86, pl. 30; Hannemann, 1961: 95, fig. 178, pl. 9, fig. 23; Liu, et al. 1983: 46, fig. 257; Razowski, 1991: 23-35, pl. 2-5, figs. 26, 116.

Laspeyresia cerasivora Matusmura, 1917, Oyo Kontyu Gaku, 1: 514; Inoue, 1954: 95.

Laspeyresia funebrana: Kennel, 1921: 650-651, Pl. 23, fig. 69; Meyrick, 1928: 590; Ford, 1949: 86; Benander, 1950: 152, fig. 14-e; Swatschek, 1958: 108-109, fig. 107; Danilevsky & Kuznetsov, 1968: 309-312, fig. 186.

Endopisa funebrana: Barret, 1906: 195.

Grapholitha (Grapholitha) funebrana: Bentinck & Diakonoff, 1968: 85-86, pl. 12, fig. 15, pl. 55, fig. 107.

Laspeyresia funebrana cerasivara Matsumura: Danilevsky & Kuznetsov, 1968: 312-313, figs. 185, 188.

Cydia funebrana: Bradley, Tremewan & Smith, 1979: 248-250, pl. 40, figs. 22-23; Dickler, 1991: 435-452 (biology); Karsholt & Razowski, 1996: no. 5084.

Adult: Wing expanse, 12 mm (Fig. 9). Head grayish ochreous; vertex suffused with dark gray. Antenna blackish gray. Labial palpus pale ochreous; terminal segment rather short. Thorax with tegula umber brown. Abdomen dark brown. Forewing subtriangular; ground color dark reddish brown; fasciate markings blackish brown; basal and sub-basal fasciae confluent, its outer edge indistinctly and strongly angulated medially; median fascia indistinctly developed, slender; costa with eight yellowish strigulae from apex to basal 1/4, basal four strigulae strongly oblique, diffuse, outer three strigulae well-defined, and bearing with three leaden striae inwards; ocelloid patch comprising four black dots, and with two plumbeous streaks on inner and outer margin; cilia gray, with a blackish subbasal line interrupted by orangeish spot below apex. Hindwing dark grayish brown, paler basally; cilia pale grayish ocher, with a fuscous subbasal line. Female is unknown in Korea.

Male genitalia (Fig. 16): Tegumen weakly developed, protruded post-apically. Valva short and broad; cucullus clavated, bearing stout spines along lower margin; sacculus with a process at lower margin. Aedeagus short (0.4 times as long as valva), pistol-like; cornuti consisting of a series (six) of filiform scales.

Material examined: [GW]- 1 ♂, Gyulamri, Jungseon, 5. VI. 1996 (H. K. Lee), CIS, gen. sl. no. UIB-111.

Flight Period: Early June.

Distribution: Korea (GW), Japan, China, Russia, and Europe.

Host plants: Korea: Unknown. Europe: fruits of *Prunus*, especially *P. spinosa* L., *P. domestica* L. (Rosaceae) and cultivated varieties. On the continental *G. funebrana* is recorded also on various other species of *Prunus* including *P. armeniaca* L., *P. persica* (L.) Bltsh, *P. domestica* L. subsp. *insititia* Bliley, *P. avium* L. and *P. japonica* Thunb. (Rosaceae) (Bradley, Tremewan & Smith, 1979).

Biology: According to Bradley, Tremewan, and Smith (1979), young larva makes a hole at the base of plum fruit near stalk and tunnels inwards. The hole is fairly conspicuous, a brown liquid frequently oozes from it and it is surrounded by frass. If a fruit is cut open, a larva may be found tunnelling in the pericarp, more generally nearer to the stone than the sides of fruits. Larval feeding habits of *G. funebrana* are similar to those of the plum sawfly, *Hoplocampa flava* (Linnaeus). The plum-fruit moth constitutes the greatest economic threat to fruit production in central Europe, and in southern European countries, however, its damage to fruits is negligible (Dickler, 1991).

Diagnosis: This species is superficially similar to *G. dimorpha* and *G. molesta*, but can be separated from them by the well-defined orange costal strigulae. In Korea, a single male was found, but larva hitherto has not been found from any kind of fruits.

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