

TWO NEW GALL-INDUCING *SAPHENISTA* WALSINGHAM
(LEPIDOPTERA: TORTRICIDAE: COCHYLINI) FROM COSTA RICA

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Abstract.—*Saphenista muerta*, n. sp., and *S. bimaculata*, n. sp., were reared from galls they induced on stems of *Monnina crepinii* Chodat (Polygalaceae) and *Ageratina ixiocladon* (Benth.) R.M. King & H. Rob (Asteraceae) respectively. Galls were discovered in a high elevation (3,000 m) oak forest on Cerro de la Muerte, Costa Rica. We present photographs of the imagos, habitat, and host; illustrations of the male and female genitalia, and descriptions of the galls.

Resumen.—*Saphenista muerta* y *S. bimaculata* nov. spp., fueron criados de agallas que se encontraban en tallos de *Monnina crepinii* Chodat (Polygalaceae) y *Ageratina ixiocladon* (Benth.) R.M. King & H. Rob (Asteraceae), respectivamente. Estas especies fueron recolectados en un bosque de roble en Cerro de la Muerte, Costa Rica; alrededor de 3,000 m.s.n.m. Se presenta fotografías de adultos, hábitat, y planta hospedera; ilustraciones de genitalia de macho y de hembra; y descripciones de las agallas.

Key Words: *Ageratina*, Asteraceae, Central America, gall-inducer, high elevations, *Monnina*, Polygalaceae, Tortricinae

Cochylini are an undisputably monophyletic group currently recognized as a tribe within the Tortricinae (Tortricidae) (Horak and Brown 1991, Horak 1998). Historically, the group has been treated by various authors as a family (e.g., Phaloniidae by Clarke (1968) and others, and Cochyliidae by Powell (1983)), subfamily (Cochyinae), or subtribe (e.g., Cochyliidii by Kuznetsov and Stekolnikov (1973), and Rawowski and Becker (1983)). The most convincing apomorphy supporting its monophyly is the loss of the gnathos in the male genitalia. Although an uncus is present in nearly all species, it is well developed in the most primitive members of the tribe (e.g.,

Trachysmia), and hence its shared loss cannot be considered an autapomorphy for the entire tribe. Cochylini includes about 930 described species (Brown 2002) assigned to about 55 genera, and occurs in all faunal regions worldwide. The larvae feed internally in flower heads, seed capsules, stalks, and roots, and most species associated with Asteraceae (Powell 1980). Cochilini larvae (e.g., Pogue 1988, Pogue and Friedlander 1987) are characterized by the presence of an anal fork (plesiomorphic condition), the occurrence of SD1 and DI on the same pinaculum on abdominal segment 9 (shared with most Olethreutinae), conspicuously enlarged pinacula (a convergent character

with some internal-feeding Grapholitini), reduced number of crochets on the prolegs (convergent with many tortricids), and a bisetose L-group on abdominal segment 9 (putative autapomorphy for the tribe).

The genus *Saphenista* (Cochylini) was described by Walsingham (1914) on the basis of several plesiomorphic characters. Based on the North American members, Pogue (1986) identified two autapomorphies for the genus: (1) valva widened basally, gradually narrowed to a rounded apex; and (2) a pocket at the base of the valva with an associated costal groove that opens to the inside. He (Pogue 1986) also identified the presence of the hindwing costal fold and 3-segmented maxillary palpus as holoplastic characters. In addition, all *Saphenista* have a distinctive transtilla with an elongate mesal process broadening distally into a Y-shaped projection. The genus includes about 75 species and occurs in all faunal regions except the Ethiopian (Pogue 1986). Only a few larval host plants have been reported for *Saphenista*, and all but one are in the Asteraceae.

The discovery of two undescribed species of *Saphenista* in stem galls during a survey of gall-inducing Lepidoptera in Costa Rica is noteworthy, and we take this opportunity to describe these two species and comment briefly on their life histories.

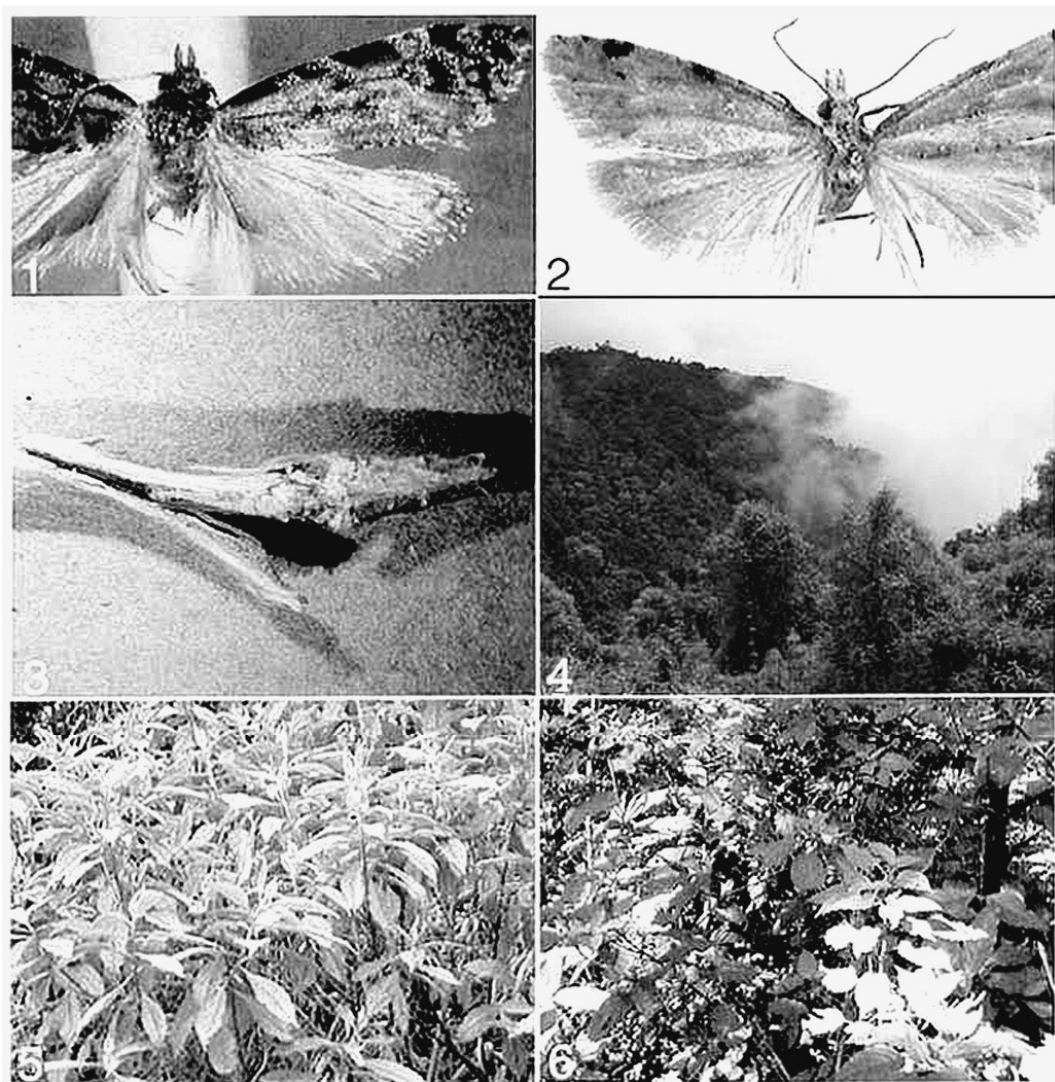
The galls, which were induced by the moth species described herein were collected from the stems of *Monnina crepinii* Chodat (Polygalaceae) and *Ageratina ixiocladon* (Benth.) R.M. King & H. Rob (Asteraceae), in a high elevation oak forest at Villa Mills (3,000 m), Cerro de la Muerte, in the provinces of San José and Cartago, Costa Rica. Species of *Monnina* are shrubs or small trees (Fig. 5) found in cloud forests. Flowers are papilionaceous and blue to bluish-purple in color; leaves are uniformly alternate. In Costa Rica, *M. crepinii* has been collected between 1,800–3,000 m on both the Atlantic and Pacific regions of the central cordillera (INBio database 1997). *Ageratina ixiocladon* is a tropical

shrub (Fig. 6) that grows 3–4 m tall, and like *M. crepinii*, is usually found in partially open areas with limited sunlight (Fig. 4). In Costa Rica, *A. ixiocladon* is known from high elevations, about 2,500 m on both the Atlantic and Pacific slopes of the central cordillera (INBio database 1997).

The forests of these high regions as described by Hartshorn (1983) and Kappelle (1996) are tropical montane rain forests or tropical montane cloud forests that are dominated by a few plant species. The transitional zone is dominated mainly by *Quercus costaricensis* Liebmann and *Q. copeyensis*, C.H. Muller (Fagaceae). Other plant species in moderate abundance are *Miconia biperulifera* Cogniaux (Melastomataceae), *Vaccinium consanguineum* Klotzsch (Ericaceae), *Weinmannia pinnata* Linnaeus (Cunoniaceae), *Schefflera rodriguesiana* D.G. Frodin (Araliaceae), and *Chusquea* spp. (Poaceae).

The climate is characterized by a wet and a dry season. The dry season lasts from December or January to April. During this time of the year, rain is infrequent, although the humidity remains high and dense fog is common. The wet season lasts from April to November or December. Heavy rains are common during these months, and the area receives an average annual rainfall of 2,812 mm. The average temperature for this area is 10.9°C and sometimes can reach -3°C during the dry season.

Galls were collected in the field, placed in plastic bags, and taken to an air-conditioned room where the temperature was kept between 16–18°C. Kornerup and Wanscher (1978) is used as a color standard for description of the adult vestiture. Genitalia were dissected as described by Clarke (1941), except mercurochrome and chlorazol black were used as stains. Adults were examined with dissecting and compound microscopes. Measurements were made using a calibrated ocular micrometer. All specimens of this study are deposited in Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, Costa



Figs. 1–6. Holotypes of *Saphenista* spp., gall, habitat, and colonies of *Monnina crepinii* and *Ageratina ixiocladon*. 1, Holotype of *S. muerta*. 2, Holotype of *S. bimaculata*. 3, Gall of *S. muerta*. 4, High elevation habitat of *M. crepinii* and *A. ixiocladon*. 5, Colony of *M. crepinii*. 6, Colony of *A. ixiocladon*.

Rica. Vouchers of *Monnina crepinii* and *Ageratina ixiocladon* are deposited in Herbario de la Universidad de Costa Rica, Escuela de Biología, San, José, Costa Rica.

***Saphenista muerta* Nishida and
Adamski, new species**
(Figs. 1, 3, 7)

Diagnosis.—*Saphenista muerta* appears most similar to *S. eneiema* Razowski, 1990,

from Costa Rica. It differs by having a forewing pattern that is darker, a socius that is broader, a valva that is narrower, an aedeagus with a longer apical spinelike process, and a vesica with a stout cornutus.

Description.—*Head*: Frontoclypeus and vertex brownish yellow; outer surface of labial palpus pale yellowish brown, with third segment pale gray intermixed with white scales; inner surface white intermixed with

few pale-gray scales; scape and basal 8–10 flagellomeres of antenna brownish yellow intermixed with gray scales, distal flagellomeres gray. Proboscis present.

Thorax: Tegula and mesonotum brownish yellow, intermixed with gray scales on caudal part. Leg with coxa and femur pale brownish yellow intermixed with pale-gray and gray scales, tibia and tarsomeres dark gray intermixed with pale gray near distal end. Forewing (Fig. 1) length 7.0 mm ($n = 1$) all fasciae golden yellow intermixed with brownish-yellow scales; costal margin brown; costal strigulae silver, basal strigulae incomplete, distal strigulae complete; cell with a dark-brown streak about $\frac{1}{2}$ length and a large dark-brown spot near distal end; fringe pale yellowish brown; undersurface brown. Hindwing pale gray, slightly darker along anterior margin; costal fold present.

Male genitalia (Fig. 7): Uncus and gnathos absent; socius elongate, setose, rounded distally; vinculum with two V-shaped parts, fused ventrally, posterior part dorsally fused with ventral articulation of valva, anterior part fused with dorsal articulation of valva; valva setose, slightly broadened basally, gradually narrowed distally forming a rounded apex; transtilla enlarged medially forming an elongate, dorsoposteriorly projecting, Y shaped process with two apically divergent tips; juxta platelike; aedeagus basally broadened, gradually narrowed distally, distal part with an elongate, protuberant spinelike process; vesica with an elongate cornutus.

Female genitalia: Unknown.

Type.—Holotype, ♂, "Costa Rica, San José [Province], Cerro de la Muerte, Villa Mills, Sendero, frente de Georgina, 3,000 m, 22-VI-1999, col/rear: Kenji Nishida, host plant *Momina* sp. stem gall inducer, 22-VI-1999, pupa in gall 1-VI-1999, adult 22-VI-1999", "COSTA RICA: INBio: CRI002, 607856" [bar code label]; "♂ IN-Bio Genitalia Slide by D. Adamski No. 890" [yellow label]. The pupal exuvium is

within a gelatin capsule and is attached to the pin of the holotype.

Etymology.—The specific epithet is derived from the locality, Cerro de la Muerte, Mountain of Death, where the gall containing the holotype was collected.

Remarks.—Spindle-shaped galls (Fig. 3) were usually located near the midlength of the stem of *Momina crepinii* near the nodes of the host plant. The galls are about 11 mm wide and about 20 mm in length. The stem width of the host is about 9 mm. An oval-shaped orifice (= exit hole) was covered with plant debris bounded with silk. The larva bores the central part of the pith of the stem. The larva of the holotype pupated in its gall chamber, spinning a loose cocoon, which was constructed with silk and frass. The pupa protruded prior to the emergence of the adult.

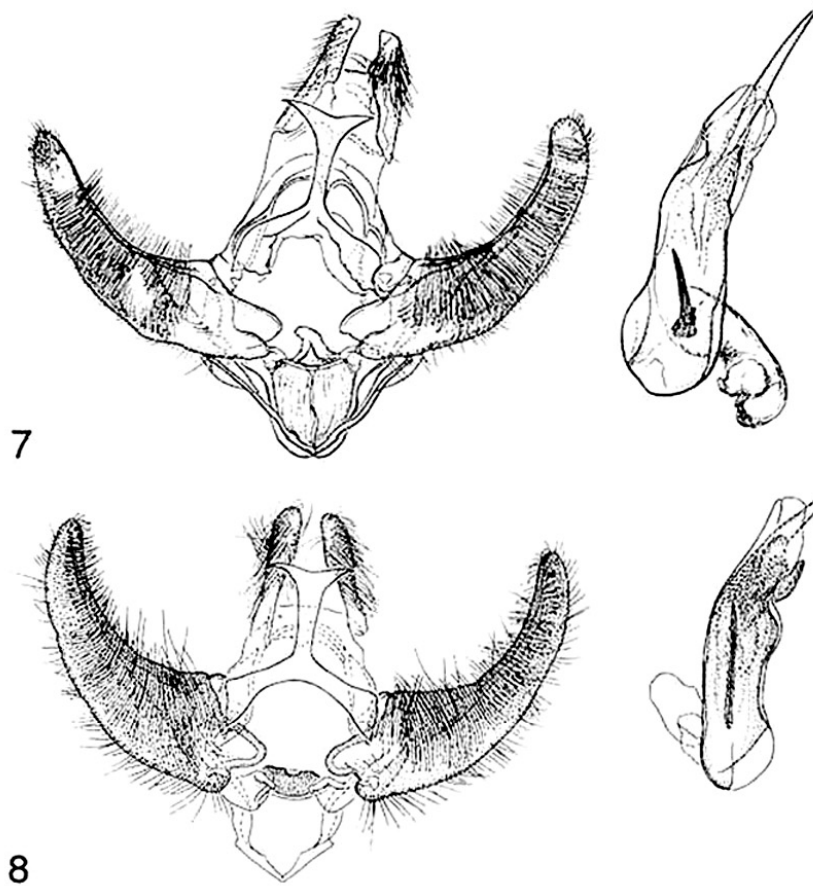
Saphenista bimaculata Nishida and Adamski, new species

(Figs. 2, 8–9)

Diagnosis.—The genitalia of *Saphenista bimaculata* are most similar to those of *S. gnathmocera* Razowski, 1990, from Costa Rica; the species share a similarly shaped valva and aedeagus, but *S. bimaculata* differs by having a narrower apical half of the valva and a stouter apical cornutus in the vesica of the aedeagus.

Description.—*Head:* Frontoclypeus and vertex pale yellowish orange; outer surface of labial palpus brown intermixed with pale yellowish-brown scales or pale yellowish brown intermixed with few brown scales; inner surface pale yellowish brown intermixed with some white scales; scape of antenna pale yellowish orange, basal half of flagellum pale yellowish orange, distal half gray; proboscis present.

Thorax: Tegula yellowish orange intermixed with pale yellowish-orange scales near distal margin; mesonotum missing most scales; legs with segments and tarsomeres brown with pale yellowish-brown apices. Forewing (Fig. 2) length 7.0–7.3 mm ($n = 3$) yellowish orange intermixed



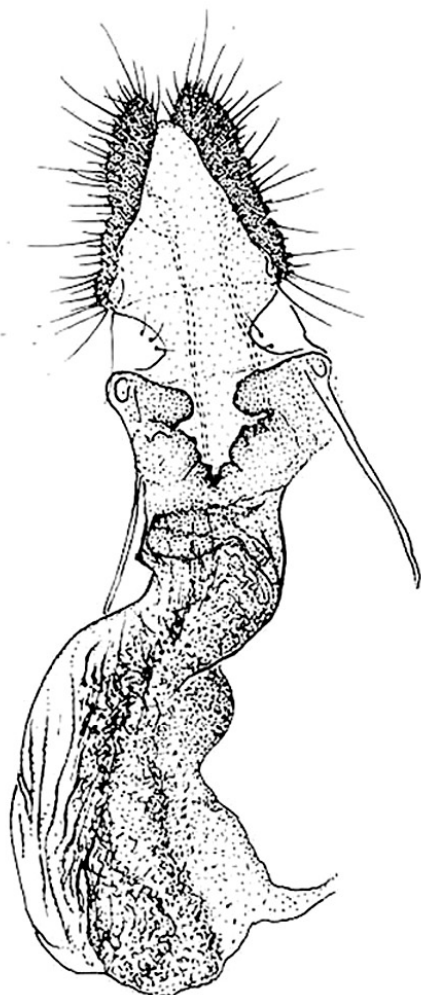
Figs. 7-8. Male genitalia, genital capsule and aedeagus of *Saphenista* spp. 7, *S. muerta*. 8, *S. bimaculata*.

with pale yellowish-orange scales; a single dark-brown spot near midcell with a diffuse spot of dark-brown scales beyond cell; costa with several small dark-brown spots and two large dark-brown spots, one near midlength and one near half distance between the first spot and apex; several small, dark-brown, paired, submarginal spots present; posterior margin with irregular row of dark-brown scales; undersurface dark brown with dark-brown costal strigulae separated by pale yellowish-orange scales along costa. Hindwing pale yellowish orange with several pale-brown irregular bands from midlength along costa to apex; costal fold present.

Male genitalia (Fig. 8): Uncus and gnathos absent; socius elongate, setose, rounded

distally; vinculum with two V-shaped parts, fused ventrally, posterior part dorsally fused with ventral articulation of valva, anterior part fused with dorsal articulation of valva; valva setose, slightly broadened basally, gradually narrowed distally forming a narrowly rounded apex; transtilla enlarged medially with an elongate, dorsoposteriorly projecting, Y-shaped process with apically divergent tips; juxta platelike; apical part of aedeagus with a ventromedian lobe, distally narrowed and angled ventrally; vesica with an elongate basal cornutus, spinulate apically with a stout cornutus.

Female genitalia (Fig. 9): Papillae anales elongate, setose, divergent anteriorly; ventral arms of sterigma slightly setose apically; apophyses posteriores dilated subba-



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Fig. 9. Female genitalia of *Saphenista bimaculata*.

sally, extending to near ostium; apophyses anteriores posteriorly bifurcate, one arm fused with dorsoanterior margin of sterigma, one curved medioventrally, forming part of a deeply notched seventh sternum; seventh sternum partially overlaid by posterior part of sixth sternum; ductus bursae, short, cylindrical; corpus bursae ovoid, with elongate creases on side opposite ductus seminalis, undulate and spinulate medially; signum absent.

Types.—Holotype, ♂, "COSTA RICA, San José [Province], Cerro de la Muerte, Villa Mills, Senderos Georgina, 3,000 m,

22-III-2000, Col[lected] and reared by Kenji Nishida, Host plant: *Ageratina* sp., Gall former on stem apex", "♂ INBio Genitalia Slide by D. Adamski No. 891" [yellow label].

Paratype: 1 ♀, Same label data as holotype except, "3000 m 21-III-2000", "Pupation: 28-III-2000", "Gall former on apex of stem", "♀ INBio Genitalia Slide by D. Adamski No. 892" [yellow label].

Etymology.—The specific epithet, *bimaculata*, is derived from the Latin maculata, meaning spot, and refers to the two large spots on the costa of the forewing.

Remarks.—Galls were found on *Ageratina ixiocladon* near the apex of the stem near the nodes (not figured). The globose or slightly elongate galls are about 6 mm wide and 7–18 mm long. The stem of the host is about 4 mm wide. Most of the larval fecal matter is ejected outside of the gall chamber through the exit hole, which later is covered with silk. Pupation occurs within or outside the gall chamber. The pupa protruded prior to adult emergence.

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LITERATURE CITED

Brown, J. W. 2002. How many species of Tortricidae are there? TORTS Newsletter 3(1): 1.

- Clarke, J. F. G. 1941. The preparation of slides of the genitalia of Lepidoptera. *Bulletin of the Brooklyn Entomological Society* 36: 149–161.
- . 1968. Neotropical Microlepidoptera, XVII. Notes and new species of Phaloniidae. *Proceedings of the United States National Museum* 125 (3600). 58 pp.
- Hartshorn, G. S. 1983. Plants: Introduction, pp. 118–157. In Janzen, D. H., ed. *Costa Rican Natural History*. Chicago University Press, Chicago, Illinois, xi + 816 pp.
- Horak, M. 1998. Tortricoidea, pp. 199–215. In Kristensen, N. P., ed. *Handbuch der Zoologie, Lepidoptera*, part 1, Volume 35, Berlin, New York. Walter de Gruyter & Co. 494 pp.
- Horak, M. and R. L. Brown. 1991. 1.2 Taxonomy and phylogeny, pp. 1–22. In van der Geest, L. P. S. and H. H. Evenhuis, eds. *Tortricid pest, their biology, enemies and control*. Elsevier Science Publishers B.V., Amsterdam.
- Kappelle, M. 1996. Los Bosques de Roble (*Quercus*) de la Cordillera de Talamanca, Costa Rica: Biodiversidad, Ecología, Conservación y Desarrollo. Universidad de Amsterdam/Instituto Nacional de Biodiversidad, xvi + 319 pp.
- Koenerup, A. and J. H. Wanschner. 1978. *Methuen Handbook of Colour*. 2nd ed. Methuen and Co., Ltd., London, 243 pp.
- Kuznetsov, V. I. and A. A. Stekolnikov. 1973. Phylogenetic relationships in the family Tortricidae (Lepidoptera) treated on the base of study of functional morphology of genital apparatus. *Trudy Vsesoyuznogo Entomologicheskogo Obschestva* 56: 18–43. [In Russian.]
- Pogue, M. G. 1986. A generic revision of the Cochylidae (Lepidoptera) of North America. Ph.D. Dissertation, Department of Entomology, University of Minnesota. xxiii + 280 pp.
- . 1988. Revision of the genus *Lorita* Busek (Lepidoptera: Tortricidae: Cochylini), with description of a new species. *Proceedings of the Entomological Society of Washington* 90: 440–457.
- Pogue, M. G. and T. P. Friedlander. 1987. *Cochylis caulocatax* Razowski (Lepidoptera: Tortricidae: Cochylini): A redescription of the male with descriptions of the female, larva, and pupa. *Proceedings of the Entomological Society of Washington* 95: 320–327.
- Powell, J. A. 1980. Evolution of larval food preferences in microlepidoptera. *Annual Review of Entomology* 25: 133–159.
- . 1983. Tortricoidea, pp. 31–42. In Hodges, R. W., ed. *Check list of the Lepidoptera of America north of Mexico*. E.W. Classey, Ltd., and the Wedge Entomological Research Foundation, London.
- Razowski, J. 1990. Cochylini (Lepidoptera, Tortricidae) from Costa Rica. *Miscellanea Zoologica* 14: 85–103.
- Razowski, J. and V. O. Becker. 1983. Brazilian Cochylidii (Lepidoptera, Tortricidae). *Acta Zoologica Cracoviensia* 26(13): 421–464.
- Walsingham, Lord (de Grey). 1914. *Lepidoptera: Heterocera*. *Biologia Centrali-Americana Lepidoptera, Heterocera*, Part 4, 482 pp. London.