The Coleopterists Bulletin, 58(2):235–244. 2004.

TWO NEW SPECIES OF *AGLYPTINUS* COCKERELL WITH UNUSUAL SEXUALLY DIMORPHIC ANTENNAE AND DIFFRACTION GRATINGS (COLEOPTERA: LEIODIDAE)

AINSLEY E. SEAGO[1] AND QUENTIN D. WHEELER
Department of Entomology, Cornell University
Ithaca, NY 14853, U.S.A.
aes42@cornell.edu

Abstract

Two Central American species of the genus *Aglyptinus* Cockerell, *A. tumerus* and *A. phymaphorus*, are described as **new species.** They are notable for unusual asymmetrical expansion of stem antennomeres and presence of conspicuous spectral iridescence on the elytra of males. Probable utility of this unusual sexual dimorphism is discussed.

The genus *Aglyptinus* Cockerell contains 21 known species of minute, brown-hued beetles with a uniformly oval and convex body shape (Newton 1998). The single New World exception is the North American species *Aglyptinus laevis* (LeConte) which is extremely convex, nearly spherical. This genus has been largely neglected by taxonomic study, but Newton (1998) noted that it contains many undescribed species worldwide. Monophyly of *Aglyptinus* has not yet been cladistically tested, but it is doubtful given the genus' holarctic distribution (partially described in Peck *et al.* 1998). Relationships to other genera of Scotocryptini, particularly those found in Africa, are also poorly understood. The most recent revision of *Aglyptinus sensu stricto* (Hlisnikovsky 1964) left species difficult to identify; the illustrations of male genitalia that are vital to confirmation of species identities lack sufficient detail. Many distinguishable but undescribed species are documented in the literature (*e.g.,* Peck *et al.* 1998; Newton 1998). Among these, and among the described *Aglyptinus* species, no conspicuous antennal modifications are noted. Known *Aglyptinus* have typical leiodiform antennae with 5-segmented clubs consisting of broad antennomeres VII and IX–XI, interrupted by a narrow antennomere VIII (as in Fig. 4).

During field studies in Panama, one of us (Wheeler) collected male specimens of *Aglyptinus* which are truly exceptional in two characters. First, these males bear conspicuously modified stem antennomeres (*i.e.,* those basal to antennomere VII) that are asymmetrical and significantly wider than any of the five club segments. Secondly, they possess patches of cuticular iridescence on the elytra that are not present on the elytra of any associated females. These unusual, spectrally-iridescent patches are produced by the interaction of incident light with a diffraction grating formed by parallel, close-packed ridges in the integument of the elytron (Figs. 10, 11), whereas in most beetles diffraction is caused by light-scattering, film-like layers in the endocuticle (Vulinec 1997) or by arrays of microscopic slits (Hinton and Gibbs 1969). While antennal structure varies greatly within the Leiodidae, no comparable, pronounced asymmetrical expansions of stem antennomeres are known elsewhere in the family. Although iridescence is widely reported in Coleoptera and Hymenoptera, including a few species of *Agathidium* (Leiodidae) (K.B. Miller pers. comm.), in these cases the

---

[1] Current address: Division of Insect Biology, University of California, 201 Wellman Hall, Berkeley, CA 94720, U.S.A.

light-diffracting structures are known or assumed to occur in both sexes. To our knowledge, this is the first report of sexually dimorphic diffraction gratings in insects and calls into question some of the usual causal explanations for such surface modifications (*e.g.,* Hinton 1973).

Additional iridescent male *Aglyptinus* found in the Essig Museum of Entomology (EMEC) at the University of California, Berkeley, include a second species with similar modifications. The stem of the antenna, while similarly expanded, involves a different combination of laterally-produced antennomeres. The existence of two such highly modified males among Central American *Aglyptinus* is extraordinary in the context of the otherwise uniform external morphology of *Aglyptinus* species from that region. In this paper we describe these two species and discuss briefly the possible significance of their unusual antennal morphology and sexually dimorphic spectral iridescence. We hope that description of these remarkable beetles will spur interest in sorely needed collection of *Aglyptinus* and in behavioral studies to explain the functional significance of their unique antennal and elytral morphology.

Material and Methods

Dissections, measurements, and drawings were done with a Wild M-5 stereoscopic microscope. Details of male genitalic structure were studied and drawn with a Leitz Dialux 20 compound microscope, using magnifications up to ×400. Measurements were made with the aid of a Lasico digital micrometer. Measurements were taken in dorsal view and include body length (measured from labral apex to tips of closed elytra), and greatest body width.

Information from original collection labels is provided verbatim and indicated by quotation marks.

Material examined was provided by:

Snow Entomological Museum at the University of Kansas, J. S. Ashe (SEMC); Lund University Zoological Museum, Sweden, Roy Danielsson (MZLU); Essig Museum, University of California Berkeley; Cheryl Barr (EMEC); American Museum of Natural History, Q.D. Wheeler (AMNH).

Taxonomy

The near uniformity of size, color, and shape among Central American *Aglyptinus* makes reference to male genitalia essential for confident species identification. Unfortunately, Hlisnikovsky (1964) did not provide sufficiently detailed descriptions or drawings of male genitalia to permit unequivocal species distinctions. While conceivable that one or both of our newly described species have been named previously based on a dimorphic counterpart (*i.e.,* conspecific males lacking modified antennae), this seems unlikely given the distinct morphology of each species' male genitalia as well as the conspicuous antennal characters. Our hypothesis, based on the relative constancy of other antennal modifications in the family, is that all males of each species will be found to possess exaggerated stem antennomeres and our species designations are therefore unique. We further hypothesize that only males have such modified antennae. Although females cannot yet be unequivocally associated with males of either new species, females were present in the various mixed-species *Aglyptinus* series collected and no modifications to any female antennae have been observed. Given the likely role of the expanded antennomeres in mating (*cf Meloe* in Pinto and Mayor 1986), we believe female antenna modifications are unlikely to exist among either of the species decribed herein.

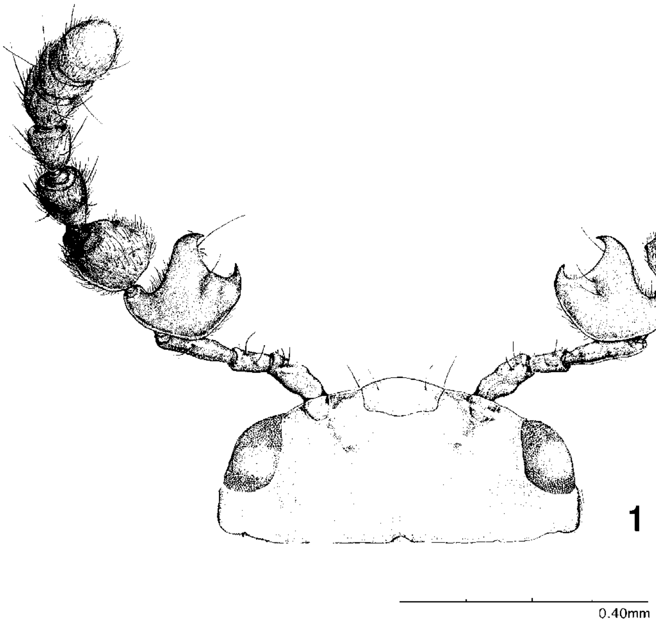


Fig. 1. Head of *Aglyptinus tumerus* Seago and Wheeler, dorsal view.

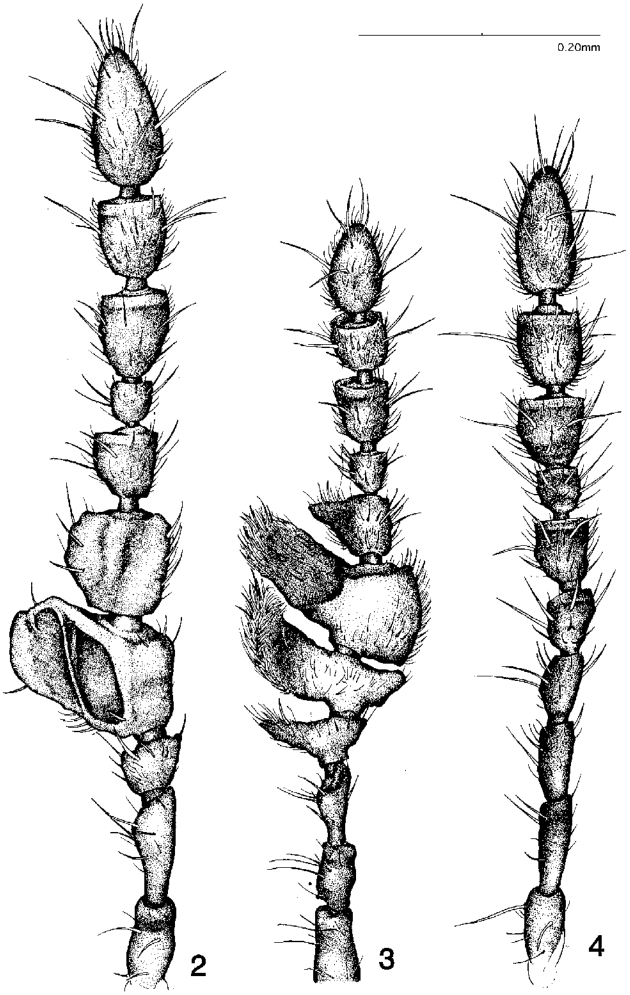
Aglyptinus tumerus Seago and Wheeler, **new species**
(Figs. 1, 2, 6, 9–11)

Holotype. Male. Panama: Chiriqui Province, 19 km NW Boquete, 2 October 1975, D. S. Chandler, sifted; under tree bark. With red label ''Holotype, Aglyptinus tumerus Wheeler & Seago, 2002.'' Deposited in American Museum of Natural History.

Paratypes. 16 males, 2 associated females from ''Panama: Chiriqui Province, Bajo Grande, 2 miles SE Cerro Punta, 6.VIII.1978, Q. D. Wheeler lot no. 7843, on myxomycete plasmodium under bark of log (AMNH).'' 6 males: ''Costa Rica, Puntarenas, Monte Verde, *ca.* 1,600 m, 11.III.1986, M. Sorensson'' (ZMLU). 3 males: ''Costa Rica, Puntarenas, Reserva Biologica de Monteverde, 1,580 m nr. Quelorada cuecha, on Senero Rio by J. Ashe, R. Brooks, R. Leschen, 13 May 1989. Snow Ent. Mus. Costa Rica Expedition #149.'' (SEMC)

Diagnosis. *Aglyptinus tumerus* and *A. phymaphorus* differ from all other species of the genus in having expanded stem antennomeres V–VI present in all males. *Aglyptinus tumerus* may be distinguished from *A. phymaphorus* by its cuplike, asymmetrically expanded male antennomere V, enlarged antennomere VI, and unmodified antennomere IV (Fig. 2).

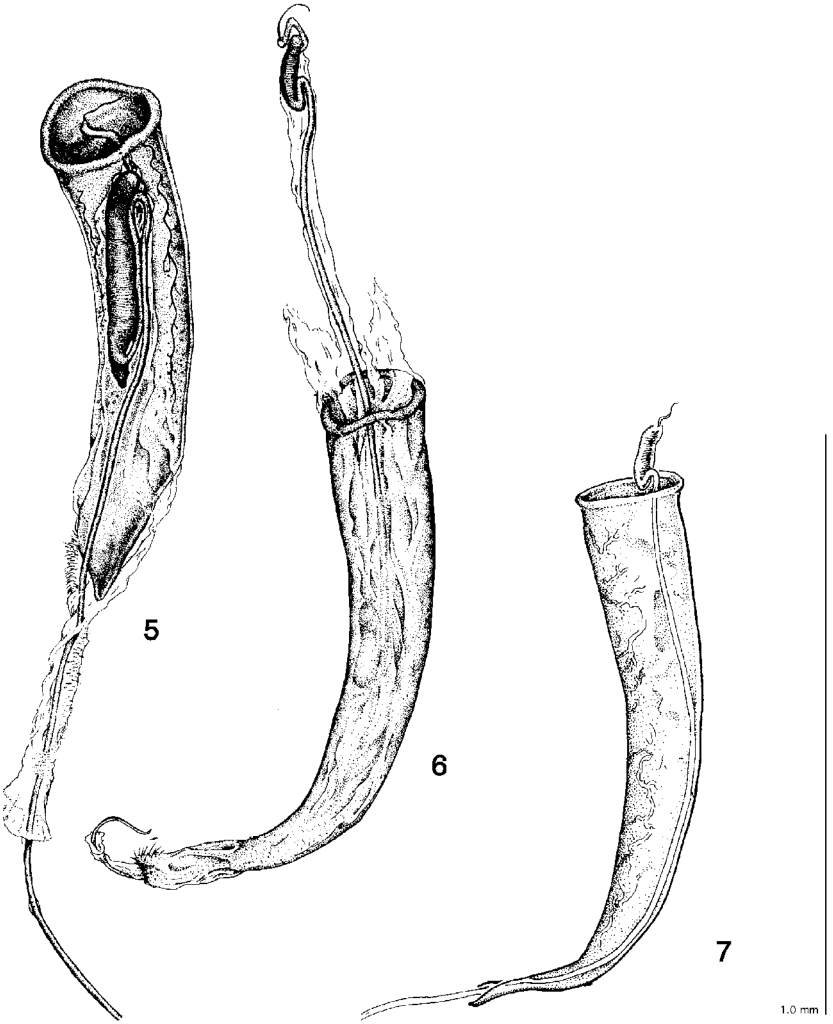
Description (male). Broadly oval, moderately convex, length 1.9–2.3 mm, width 1.4–1.8 mm. Color golden testaceous to reddish-brown, aenescent; elytra semi-translucent, often pale along suture. Elytra with spectral iridescence on apical half, with subtriangular dark brown spots subapically; spots more opaque than surrounding cuticle, sometimes faded to light golden color. Elytral microsculpture of iridescent regions comprises numerous close-packed, short, parallel ridges (Figs. 9–11). Head broad, subquadrate; minute swelling of anterior margin above antennae; surface smooth, shiny, with sparse, minute setiferous punctules (Fig. 1). Antennae with 7-segmented club composed of antennomeres V–XI, interrupted by small antennomere VIII; V



Figs. 2–4. Antennae of males. **2)** *Aglyptinus tumerus*; **3)** *A. phymaphorus*; **4)** associated unmodified male, *Aglyptinus* sp.

largest, cuplike with deep groove containing several large setae, more than 2× width VI; VI about 1.5× width VII; VII–XI as in other *Aglyptinus* (Fig. 2). Pro- and mesobasotarsomeres about 2× the width of other tarsomeres, with ventral spatulate setae; length basal tarsomere less than next two combined. Median lobe of aedeagus with apical 1/4 slightly curved in lateral view; reservoir at base of flagellum less than 1/6 length median lobe (Fig. 6). Due in part to the extreme difficulty of dissecting the aedeagal parameres intact, these appendages were not examined; they have not been included in past treatments of the genus (*e.g.*, Hlisnnikovsky 1964) and will not be introduced into this analysis.

Variation. While all observed specimens fell within the range indicated above, there appeared to be two size classes, one ''large'' (about 2.2 mm) the other ''small'' (about 2.0 mm). Color varies from pale aenescent to deeper testaceous.

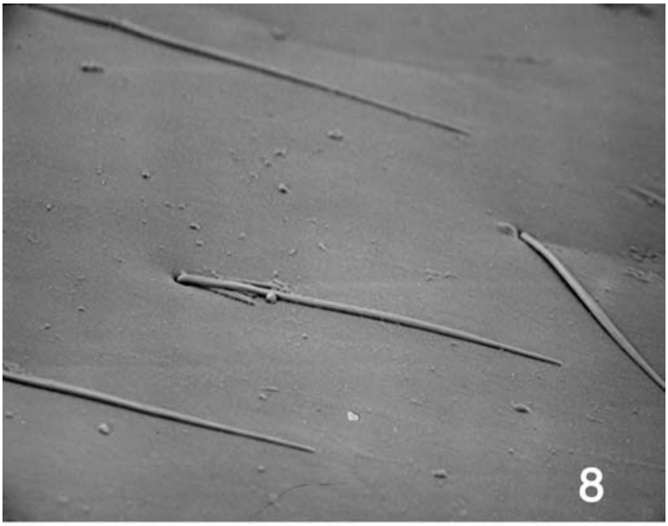


Figs. 5–7. Median lobe of male genitalia. **5)** *Aglyptinus phymaphorus*; **6)** *A. tumerus*; **7)** *Aglyptinus* sp.

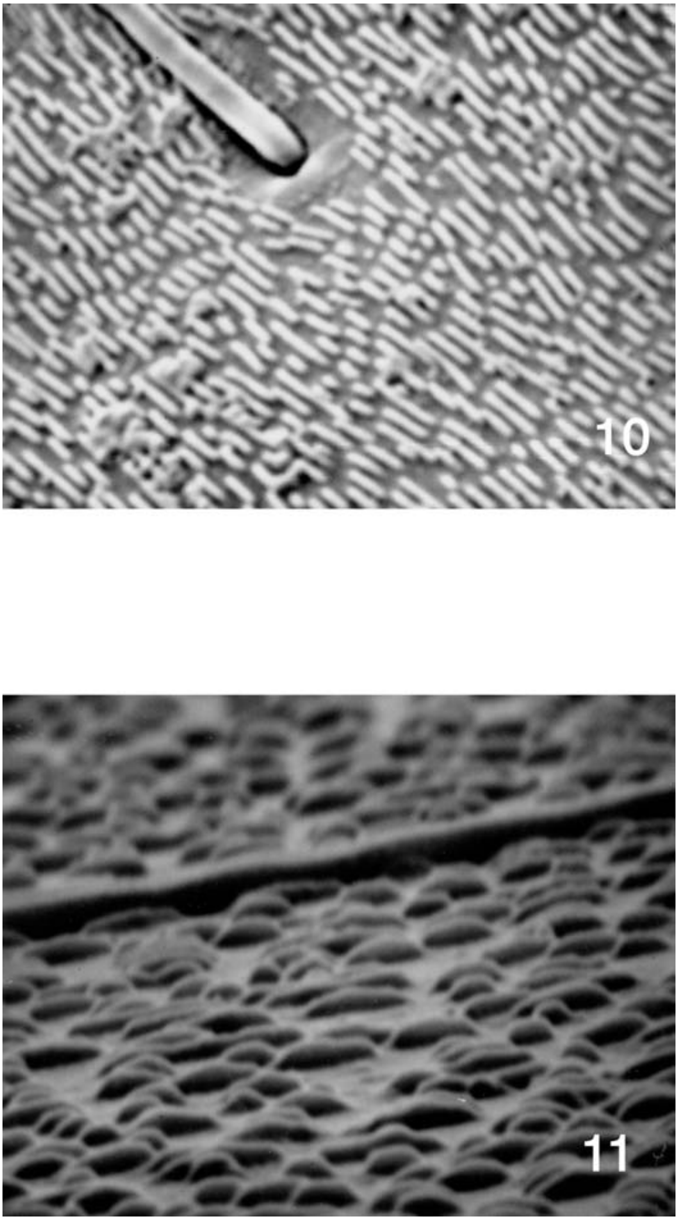
Etymology. From the Latin *tumor*, a swelling, in reference to the enlarged antennomeres V and VI.

Aglyptinus phymaphorus Seago and Wheeler,**new species**
(Figs. 3, 5)

Holotype. Male. ''Costa Rica, Tres Rios, 8.xii.1955, B. Malkin, in mushrooms on trees.'' With red label ''Holotype, Aglyptinus phymaphorus Seago & Wheeler, 2002.'' Deposited in EMEC.



Figs. 8, 9. Elytral microsculpture (2620×). **8)** Non-iridescent female; **9)** iridescent male.



Figs. 10, 11. Diffracting microsculpture of male *A. tumerus* (5450×). **10)** Dorsal view; **11)** lateral-oblique view.

Paratype. Male. ''Costa Rica, Cartago, 5 km S El Palme, 14.VII.1973, J. Doyen and P.A. Opler.'' Deposited in EMEC.

Diagnosis. *Aglyptinus phymaphorus* may be distinguished from *A. tumerus* by its asymmetrically expanded antennomeres IV, V, and VI, antennomere V not having deep groove as in *A. tumerus*.

Description (male). As in *A. tumerus*, except as follows. Length 2.2 mm, width 1.6 mm. Color golden brown; as material examined was both aged and dried, this lighter hue may be an artifact of preservation and subject to the variation of pale to darker brown observed among *A. tumerus*. Elytra with spectral iridescence on apical third, likely due to microscultpure as in *A. tumerus*. Antenna with 8-segmented club composed of antennomeres IV–XI, interrupted by small antennomere VIII; VI largest; V and VI about 3× width of III, nearly palmate, narrow at base; no antennomeres cuplike (Fig. 3). Median lobe of aedeagus with apical 1/4 more curved in lateral view than in *A. tumerus;* reservoir at base of flagellum less than 1/5 length median lobe (Fig. 5).

Etymology. From the diminutive of the Greek *phyma,* tumor or growth, plus the Greek *phor,* to carry, for the swollen antennomeres IV, V, and VI.

Aglyptinus sp.
(Figs. 4, 7)

Males without modified antennae were collected in association with both *A. tumerus* and *A. phymaphorus*, and mixed series of *A. tumerus* and unmodified males were observed in the Lund, EMEC, and Snow Museum material. We note this association in part because of the similarity (aside from antennal structure) of these males to our newly described species and because they are also candidates for association with females present. These males are most likely a distinct species, relatively recently divergent from the ancestral *tumerus*/*phymaphorus* lineage.

The unnamed males resemble *A. tumerus* and *A. phymaphorus* in size, shape, and color, including elytral spectral iridescence and small, triangular pigmented spots near the tips of the elytra. Aside from their unmodified antennae, they differ most conspicuously in having the reservoir near the base of the flagellum very large and in having small flanges on the flagellum (Fig. 7). Revision of the genus being outside the scope of this study, the state of *Aglyptinus* taxonomy does not permit us to provide a credible name for these ''normal'' males.

Material Examined. Fifteen males collected with *A. phymaphorus* holotype, ''Costa Rica, Tres Rios, 8.xii.1955, B. Malkin, in mushrooms on trees'' (EMEC) . 14 males collected with *A. tumerus*, ''Costa Rica, Puntarenas, Monte Verde, *ca.* 1,600 m, 11.III.1986, M. Sorensson'' (MZLU) 10 males collected with *A. tumerus*, ''Costa Rica, Puntarenas, Reserva Biologica de Monteverde, 1,580 m nr. Quelorada cuecha, on Senero Rio by J. Ashe, R. Brooks, R. Leschen, 13 May 1989.'' (Snow Ent. Mus. Costa Rica Expedition #149)

Discussion

Ecology. Host associations of *Aglyptinus* are not well known. Species in this genus are frequently encountered on the surfaces of gilled mushrooms and other fungi in Central America (Peck *et al.* 1998). Due in part to the difficulty of identifying *Aglyptinus* at the species level, no further patterns in host associations have been reported. Other genera of Scotocryptini are associated with fungi, bat guano, or are inquilines in the nests of stingless bees (Wheeler 1979; Peck *et al.* 1998). The single *Aglyptinus* species found in the United States, *A. laevis*, has been associated with plasmodia of Myxomycetes (Stephenson *et al.* 1993). Although one specimen of *A. tumerus* was associated with a plasmodium in Panama, *A. phymaphorus* was collected from gilled basidiomycetes, and *A. tumerus* observed in the field were found upon fungus-covered logs.

Antennal modifications. Although the interrupted 5-segmented antennal club is typical of most Leiodidae, the family exhibits a wide range of variation in antennal structure including reduction to ten antennomeres (*Anogdus* LeConte), reduction of club to 3-segments (*e.g., Agathidium* Panzer), and even a compact 4-segmented club (*Zeadolopus* Broun). Throughout this considerable variation, we know of no other cases of such asymmetrical enlargement of antennomeres nor the enlargement of stem antennomeres (*i.e.,* those basal to antennomere VII). These swollen antennomeres are reminiscent of antennae in only distantly-related Coleoptera, *e.g., Phymaphora* Newman (Endomychidae) and *Collops* LeConte (Melyridae); both members of Cucujiformia.

Enlargement of mid-antennal segments does occur in some blister beetles (Meloidae), notably in the genus *Meloe* Linnaeus. Several North American species of *Meloe* have c-shaped ''kinks'' involving antennomeres V–VII, thought to be involved in courtship (Bland 1986). Males of *M. niger* have been observed using their modified antennae to grasp females by their antennae during pre-mating displays (Pinto and Mayor 1986). We have no detailed behavioral observations of the new species of *Aglyptinus*, but note that the inner surface of the deep grooves on antennomere IV of *A. tumerus* lacks any visible sensilla, suggesting a mechanical, rather than sensory, purpose. Enlarged club segments in other leiodids frequently possess a complex internal set of sensilla (the ''Hamann's organ'') with openings to the distal periarticular gutter of the antennomere (*e.g.,* Newton 1998). We have observed no indications of Hamann's organs in these modified stem antennomeres, nor has scanning electron microscopy of *A. tumerus* revealed any unusual sensory structures.

Sexual dimorphism in diffraction gratings. Iridescence due to microscopic cuticular gratings has been documented in many beetles and Hymenoptera. We have observed the iridescent elytral surface of male *A. tumerus* with a scanning electron microscope and confirmed the presence of such parallel gratings and the absence of the same in females (Figs. 8, 9). Previous reports of such diffraction structures have noted or assumed occurrence in both sexes (*e.g.,* Hinton and Gibbs 1969). Although a few females showed a faint trace of iridescence, the gratings appear to be fully developed only in males.

Hinton (1973) speculated that diffraction gratings evolved as a defense against predators, creating a glare so intense as to disrupt a predator's attack. Visually-preying birds have been shown by Schultz (1986) to exert the greatest selection pressure on cuticular characters of iridescent tiger beetles. Schultz's explanation states that the iridescence interferes with depth perception as the predator moves rapidly toward its prey. If this is the case for iridescent *Aglyptinus*, males would benefit from this ''optical defense'' only during diurnal activity. We do not comment on the credibility of the Hinton model *per se*, but merely observe that the existence of sexual dimorphism suggests a more complex story. Two additional clues may be added: we have seen and collected other *Aglyptinus* from host fungi during the day, and we have observed that males assume a dorsal position while mating. Were Hintonian protection from predators imparted by these diffraction gratings, the male's position would potentially protect the female during copulation.

Acknowledgments

We thank Drs. Kelly B. Miller and Kipling Will for advice and comments on drafts of this paper; the University of California, Berkeley, Essig Museum and the Zoological

Museum at Lund University, Sweden, for making specimens available for study; and the Cornell University Presidential Scholars program for support of the senior author.

Literature Cited

Bland, R. G. 1986. Antennal and mouthpart sensilla of the blister beetle, Meloe campanicollis (Coleoptera: Meloidae). Great Lakes Entomologist 19(4):209–215.

Hinton, H. E., and D. F. Gibbs. 1969. An electron microscope study of the diffraction gratings of some carabid beetles. Journal of Insect Physiology 15:959–962.

Hinton, H. E. 1973. Natural deception [pp. 97–160]. *In:* Illusion in nature and art (R. L. Gregory and E. H. Gombrich, editors). Charles Scribner's Sons, New York.

Hlisnikovsky, J. 1964. Die Gattung *Aglyptinus* Cock. (Coleoptera, Leiodidae, Agathidiini). Reichenbachia 2:185–198.

Newton, A. F., Jr. 1998. Phylogenetic problems, current classification and generic catalog of world Leiodidae (including Cholevidae). Bolletino del Museo Regionale di Scienze Naturali diTorino 1998:41–178.

Peck, S. B., P. Gnaspini, and A. F. Newton. 1998. Catalogue and generic keys for the Leiodidae of Mexico, West Indies, and Central and South America (Insecta: Coleoptera). Giornale Italiano di Entomologia 9(48):37–72.

Pinto, J., and A. Mayor. 1986. Size, mating success and courtship pattern in the Meloidae (Coleoptera). Annals of the Entomological Society of America 79:597–604.

Schultz, T. 1986. Role of structural colors in predator avoidance by tiger beetles of the genus *Cicindela* (Coleoptera: Cicindelidae). Bulletin of the Entomological Society of America 32:142–146.

Silbergleid, R. E. 1979. Communication in the ultra-violet. Annual Review of Ecology and Systematics 10:373–398.

Stephenson, S. L., Q. D. Wheeler, J. V. McHugh, and P. R. Fraissinet. 1993. New North American assocations of Coleoptera with Myxomycetes. Journal of Natural History 28: 921–936.

Vulenic, K. 1997. Iridescent dung beetles: a different angle. Florida Entomologist 80:132–141.

Wheeler, Q. D. 1979. Revision and cladistics of the Middle American genus *Creagrophorus* Matthews (Coleoptera: Leiodidae). Quaestiones Entomologicae 15:447–479.

(Received 12 August 2002; accepted 15 September 2003. Publication date 13 July 2004.)