

Chromosome numbers of some Brentid and Curculionid weevils from Puerto Rico and the U.S. Virgin Islands^{1,2}

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ABSTRACT

Chromosomes of 24 curculionoid species from the Greater Puerto Rico Region, including the U.S. Virgin Islands are listed. Seven are endemic and eight are notable agricultural pests. The male meioformula of the broad-nosed weevils (Brachyderinae, Otiorhynchinae) as well as of the brentid *Cylas formicarius ellegantulus* is the expected $10 + Xy_p$, except for the phyllobiine *Lachnopus kofresi* from Mona Island ($16 + Xy_p$). Representatives of the other curculionid subfamilies had higher autosomal numbers and primitive sex bivalent, Xy_p . An exception was *Anthonomus eugenii*, which has a sex trivalent (X_1X_2Y) in the male. For morphological and cytological reasons, *Lachnopus coffeae montanus* Marshall, *L. seini* Wolcott, and *L. yaucona* Wolcott were synonymized with *L. coffeae* Marshall (NEW SYNONYMIES). One species of *Ischionoplus* (Brachyderinae) is new to science and it is endemic for Mona Island.

Key words: Chromosomes, Coleoptera, Curculionidae, Brentidae

RESUMEN

Números cromosómicos de algunos escarabajos de las familias Brentidae y Curculionidae de Puerto Rico y las Islas Vírgenes de Estados Unidos

Se preparó una lista de los cromosomas de 24 especies de Curculionoides de la Gran Región de Puerto Rico y de las Islas Vírgenes de U.S.A. Siete especies son endémicas y ocho son plagas notables en la agricultura. La meiofórmula del macho de los picudos de nariz ancha (Brachyderinae, Otiorhynchinae) así como del bréntid *Cylas formicarius ellegantulus* es la esperada $10 + Xy_p$, excepto en *Lachnopus kofresi* de la Isla de Mona ($16 + Xy_p$). Representantes de otras subfamilias de Curculionidae tienen números autosomales más altos y combinados con el bivalente sexual primitivo Xy_p . *Anthonomus eugenii*, con su trivalente sexual (X_1X_2Y) en el macho, es una excepción. Por razones morfológicas y citológicas los taxones *L. coffeae montanus* Marshall, *L. seini* Wolcott y *L. yaucona* Wolcott fueron sinonimizados con *Lachnopus coffeae* Marshall (SINONIMIAS NUEVAS). Una especie

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de *Ischionoplus* (Brachyderinae) es nueva para la ciencia y es endémica para la Isla de Mona.

INTRODUCTION

In this paper we list taxonomically chromosomal data collected while investigating how much intraspecific difference *Lachnopus curvipes* (Curculionidae: Brachyderinae: Barynotini) and *Diaprepes abbreviatus* (Curculionidae: Otiorhynchinae: Phyllobiini), both notorious agricultural pests, might show in their genetics and cytology. Little has been achieved in this respect (Hantula et al., 1987; Virkki and Sepúlveda, 1990). The broad-nosed curculionids (Brachyderinae and Otiorhynchinae) are not especially inviting subjects for chromosome comparison because of their prevailing diploid number of 22, and the (male) meioformula of $10 + Xy_p$ (Smith and Virkki, 1978; Takenouchi, 1981), except where parthenogenesis is combined with polyploidy (Suomalainen et al., 1987). However, the large "parachute" sex bivalent (Xy_p) of *D. abbreviatus* and especially of *Lachnopus* spp., was found suitable for cytochemical studies (Virkki et al., 1990; 1991). *Lachnopus curvipes* was studied primarily because it was very common. *Anthonomus eugenii* has $2n = 31(X_1, X_2, y_p)$; $14 + X_1X_2y_p$ (δ) (Bárcenas, 1992). An undescribed species of *Ischionoplus* Chevrolat is new to this region, with the only previously known species from Cuba and the Dominican Republic. Chromosomally, it is a typical Brachyderine, with meioformula $10 + Xy_p$. Otherwise, the curculionoid species of Puerto Rico and the Virgin Islands not included in the list remain unknown cytologically.

METHODS

Living beetles were stored overnight in an icebox at about 20°C. Testis and ovariole squashes were made, using rapidly fixing Kahle-Smith fluid (Virkki, 1983 Schedule 5). Most preparations were studied and photographed (Figures 1 to 4) with phase contrast optics. If stains were used, they are mentioned in the figure captions. A Zeiss Photomicroscope II^s and Kodak Plus-X Pan 35 mm film were used throughout.

Instead of meiograms, we have used original photographs to illustrate the list because most of these chromosomes have not been published previously. Karyograms were not prepared because the premeiotic mitoses were scanty.

^sTrade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or material by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

List of chromosome numbers of some Brentid and Curculionid weevils from Puerto Rico and the U.S. Virgin Islands. Numbers in the column "Islands" refer to footnotes concerning mainly the collection sites and food plants.

Taxons	Islands	#Processed	Karyoformula	Meioformula
BRENTIDAE				
Cyladini				
b <i>Cylas formicarius elegantulus</i> (Summer)	PR ¹	8		10 + Xy _p
CURCULIONIDAE				
BRACHYDERINAE				
Naupactini				
a <i>Artipus monae</i> Wolcott	Mona	45		10 + Xy _p
Barynotini				
ab <i>Lachnopus coffeae</i> Marshall	PR ²	162	2n = 22(2X) ♀ 2n = 22(X,y) ♂	10 + Xy _p
<i>Lachnopus curvipes</i> Fabricius	PR, Icaicos, Culebra, Vieques, St. John ³	320	2n = 22(X,y) ♂	10 + Xy _p
a <i>Lachnopus kofresi</i> Wolcott	Mona	5		16 + Xy _p
<i>Lachnopus valgus</i> Fabricius	St. Croix St. John ⁴	68		10 + Xy _p
a <i>Ischionoplus</i> sp.	Mona ⁵	1		10 + Xy _p
Polydrusini				
<i>Apodrosus argentatus</i> Wolcott	PR	5		10 + Xy _p
<i>Apodrosus wolcottii</i> Marshall	PR ⁶	1		10 + Xy _p
OTIORHYNCHINAE				
Phyllobiini				
a <i>Compsus luquillo</i> Wolcott	PR ⁷	2	2n = 22(2X) ♀ 2n = 22(X,y) ♂	10 + Xy _p
a <i>Compsus maricao</i> Wolcott	PR ⁸	85	2n = 22(X,y) ♂	10 + Xy _p
b <i>Diaprepes abbreviatus</i> (L.)	PR, Culebra, Vieques ⁹	645	2n = 22(2X) ♀ 2n = 22(X,y) ♂	10 + Xy _p
<i>Diaprepes maugei</i> (Boheman)	PR ¹⁰	2		10 + Xy _p
b <i>Diaprepes rohri</i> (Fabricius)	St. Croix ¹¹	5		10 + Xy _p
a <i>Exophthalmus roseipes</i> (Chevrolat)	PR ¹²	74	2n = 22(2X) ♀ 2n = 22(X,y) ♂	10 + Xy _p
<i>Exophthalmus quindecimpunctatus</i> (Olivier)	PR, Culebra	8		10 + Xy _p

(Continued) List of chromosome numbers of some Brentid and Curculionid weevils from Puerto Rico and the U.S. Virgin Islands. Numbers in the column "Islands" refer to footnotes concerning mainly the collection sites and food plants.

Taxons	Islands	#Processed	Karyoformula	Meioformula
MOLYTINAE				
Sternechini				
<i>Sternechus vicinus</i> Fleu- tiaux & Sallé	PR	1		10 + Xy _p
ANTHONOMINAE				
Anthonomini				
b <i>Anthonomus eugenii</i> Cano	PR ¹⁴	10		14 + X ₁ X ₂ Y
b <i>Anthonomus flavus</i> Bohe- man	PR ¹⁵	10		11 + Xy
CRYPTORHYNCHINAE				
Ithyporini				
b <i>Conotrachelus sapotae</i> Barber	PR ¹⁶	12		20 + Xy _p
Cryptorhynchini				
<i>Sternocoelus</i> sp.	PR ¹⁷	1		16 + Xy _p
BARIDINAE				
Peridinetini				
<i>Peridinetus signatus</i> Rosenschoeld	PR ¹⁸	13		13 + Xy _p
RHYNCHOPHORINAE				
Rhynchophorini				
b <i>Cosmopolites sordidus</i> (Germar)	PR ¹⁹	4		14 + Xy _p
COSSONINAE				
Cossonini				
<i>Cossonus hamiltoni</i> Slosson	PR ²⁰	15		17 + Xy _p

a = known from one island only, probably endemic; b = notorious agricultural pest; PR = Puerto Rico.

1. Isabela Substation (*Ipomoea batata*). 2. Indiera Alta (*Coffea arabicum*); Mt. Guilarte; Road 128, Yauco; Barrio Hayales, Coamo (*Rapanea coriacea*); Road 358, Adjuntas; and elsewhere, from unidentified vegetation. 3. Barrio Hayales, Coamo (*Psidium guajaba*); Maunabo (*Melicoccus bijugatus*); Road 165, Dorado (*Dalbergia ecastaphyllum*); Jobos Beach, Isabela (*Croton rigidus*); Road 10 East, St. John, on a yellow-flowering leguminosae; also from Culebra, Vieques, Icacos, Vacía Talega, Vega Baja, Tortuguero Beach, Yauco, and Yabucoa, on unidentified vegetation. 4. Road 78, Mt. Eagle, St. Croix (*Guapira fragrans*); Road 10 East, St. John, from unidentified vegetation. 5. From *Citrus sinensis*. 6. El Verde. This specimen, identified by the AES entomologists in 1963, has since disappeared from the museum collection. 7. Carite Forest (*Cecropia peltata*). 8. Road 143, Toro Negro (*Miconia pycnoneura*); Cerro Maravilla (*Rubus rosifolia*); Road 388, Adjuntas (*Miconia* near *prasina*). 9. Adjuntas Substation (*Citrus* spp.); Carraízo Alto, Trujillo Alto (*Mangifera indica*); Catalina nursery, El Yunque (*Swietenia mahagoni*, *Persea americana*); Corozal Substation (*Citrus* spp., *Teobroma cacao*); Culebra (*Cajanus cajan*, *Croton*

(Continued) List of chromosome numbers of some Brentid and Curculionid weevils from Puerto Rico and the U.S. Virgin Islands. Numbers in the column "Islands" refer to footnotes concerning mainly the collection sites and food plants.

sp.); Dorado (*Citrus sinensis*, *Persea americana*); Fortuna Substation (*Persea americana*); Barrio Hayales, Coamo (*Citrus sinensis*, *Persea americana*); Isabela Substation (*Cajanus cajan*, *Citrus sinensis*, *Gliricidium sepium*, *Mangifera indica*, *Persea americana*); Jiménez, El Yunque (*Cajanus cajan*); Maunabo (*Citrus* sp.); Vacía Talega (*Conocarpus erectus*); Vega Baja (*Dalbergia ecastaphyllum*); Vieques (*Mangifera indica*); Yabucoa (*Andira inermis*, *Persea americana*). In addition, Gurabo, Maricao Forest, Montebello, Río Piedras, Salinas, Sierra Bermeja, on unidentified vegetation. 10. Cerro Maravilla, Toro Negro (*Rubus rosifolius*). 11. St. Croix (*Citrus* sp.). 12. Dorado (*Dalbergia ecastaphyllum*); Jobos Beach, Isabela (*Croton rigidus*); Río Piedras (*Andira inermis*); Vacía Talega (unknown vegetation). 13. Culebra and Vega Alta (*Guapira fragrans*). 14. Isabela Substation (*Capsicum frutescens*). 15. Carraízo Alto, Trujillo Alto (*Malpighia puniceifolia*). 16. Fortuna Substation (*Manilkara zapota*). 17. Carraízo Alto, Trujillo Alto (at lights). 18. Juana Díaz, Cabo de Mala Pascua, and Rucio, Peñuelas (*Piper* spp.). 19. Carraízo Alto, Trujillo Alto (*Musa paradisiaca*). 20. Road 511, Juana Díaz (*Erythrina poeppigiana*).

The majority of the species were identified by N. Virkki. Charles W. O'Brien verified these identifications and identified the remainder of the species. All species are vouchered in the latter's private collection in Tallahassee.

REMARKS

Cylas has been transferred from Curculionidae to Brentidae (Thompson, 1992; Kuschel, 1995). *Cylas formicarius elegantulus* has the common curculionoid meioformula, $10 + Xy_p$. The sex bivalent, tentatively determined as Xy_p , is exceptional in that the y chromosome is unusually large. Also the substance keeping X and y together does not stain with the AgNOR technique (Virkki, unpubl.), resembling the substance joining X_2 to y in the sex trivalent of an elaterid, *Pyrophorus luminosus* (Virkki et al., 1984). Manna and Lahiri (1972) have listed but not illustrated similar chromosome data ($2n = 22; 10 + Xy_p$) for the Old World *C. formicarius*.

We use the name *Lachnopus* Schoenherr 1840, although the names *Menoetius* Dejean 1821 and *Ptilopus* Schoenherr 1823 are older because the International Commission of Zoological Nomenclature (ICZN, 1987) has ruled on a proposal by O'Brien and Wibmer (1986) to reject the latter two names and has added the name *Lachnopus* as the official genus-group name, validating it. All other names follow O'Brien and Wibmer (1982).

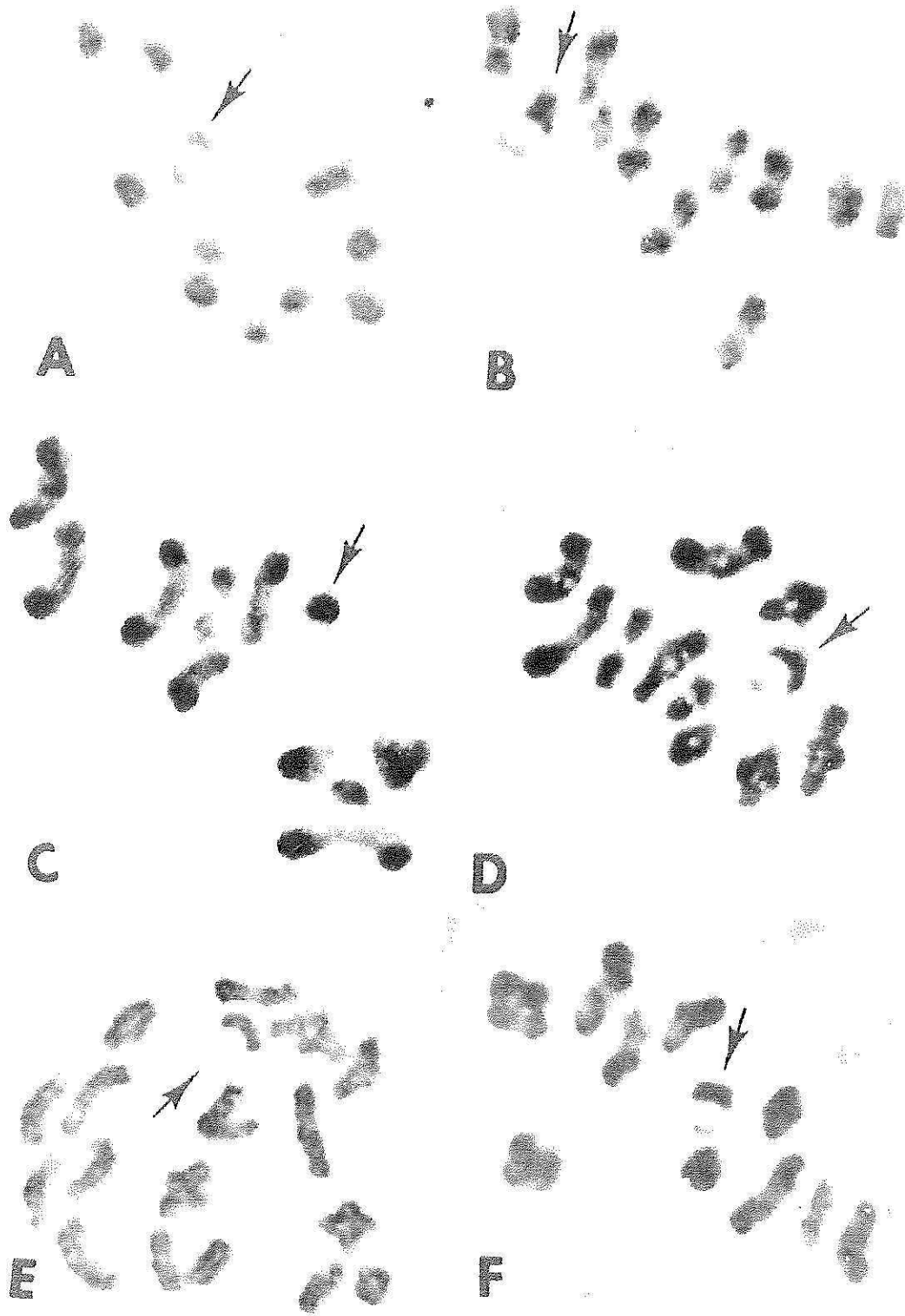


FIGURE 1. A to F. First meiotic division of male. Except for *Lachnopus kofresi*, all show $10 + Xy_p$. Arrow points to the sex bivalent. A. - *Cylas formicarius elegantulus*. 3032x. B. - *Artipus monae*. 2507x. C. - *Lachnopus coffeae*. 2507x. D. - *Lachnopus curvipes*, 2507x. E. - *Lachnopus kofresi*. $16 + Xy_p$. 2507x. F. - *Lachnopus valgus*. 2507x.

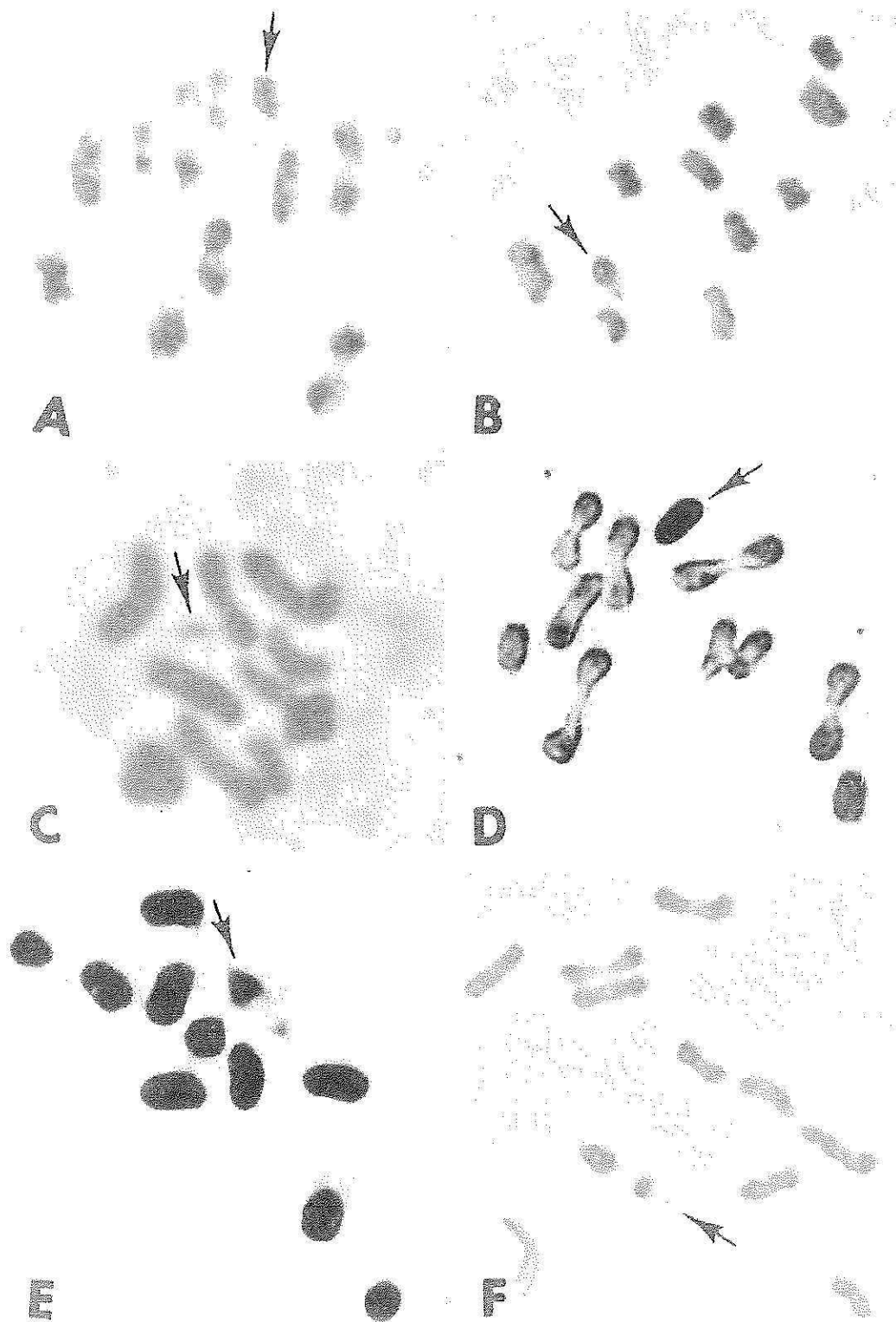


FIGURE 2. A to F. First metaphase of male meiosis. All show $10 + X_y$. Arrow points to the sex bivalent. A. - *Ischionoplus* sp. 2337x. B. - *Apodrosus argentatus*. 2337x. C. - *Aprodosus wolcottii*. Acetocarmine. 2900x. D. - *Compsus luquillo*. Silver staining, normal optics (cf. Virkki et al., 1991). 2507x. E. - *Compsus maricao*. 2507x. F. - *Diaprepes abbreviatus*. 1930x.

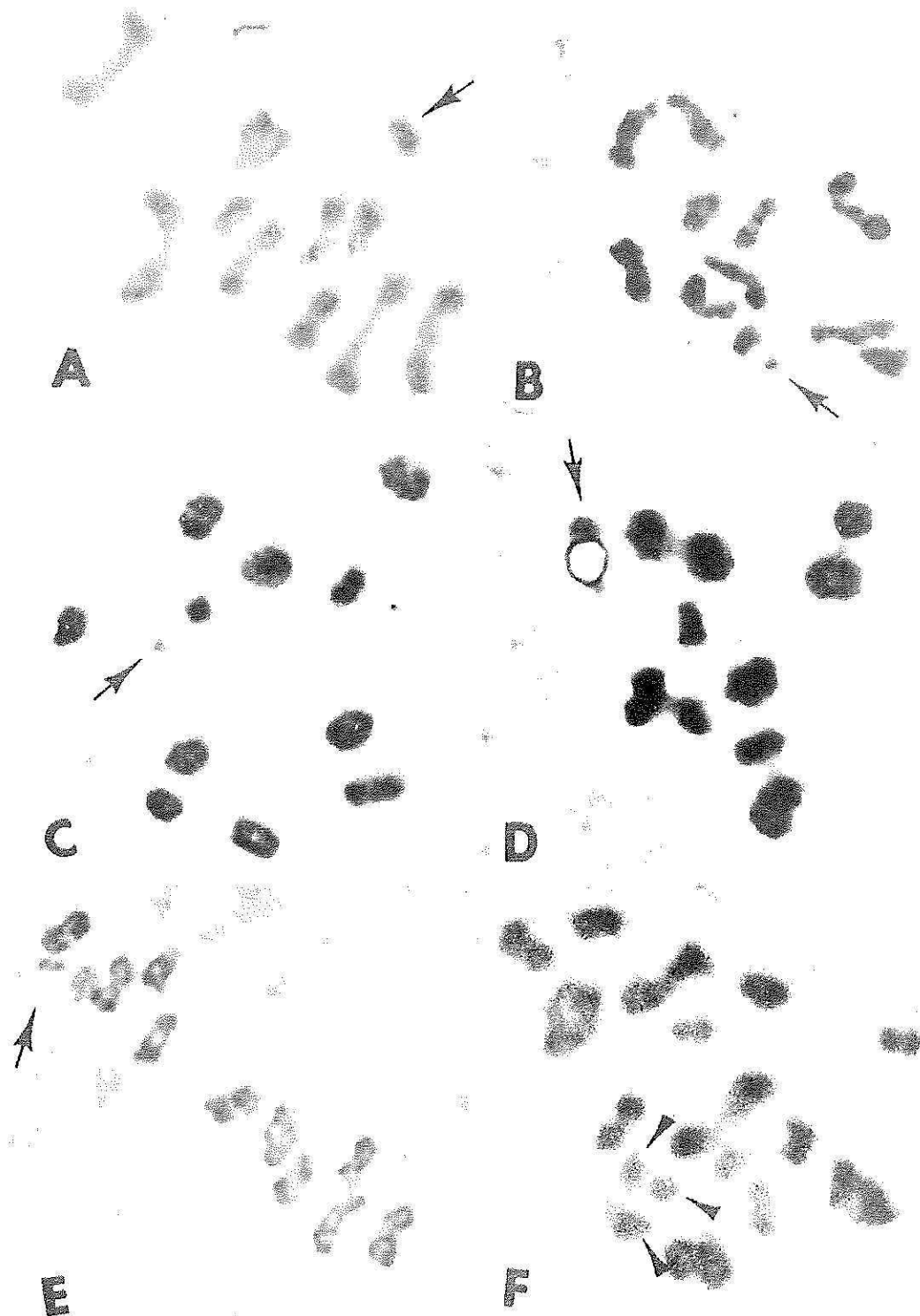


FIGURE 3. A to F. First meiotic division of male. Arrow points to the sex bivalent in A to E. A. - *Diaprepes maugei*. $10 + Xy_p$, 2163x. B. - *Diaprepes rohrii*. $10 + Xy_p$, 2507x. C. - *Exophthalmus roseipes*. $10 + Xy_p$, 2507x. D. - *Exophthalmus quindecimpunctatus*. $10 + Xy_p$. Silver staining + phase contrast (cf. Virkki et al., 1991). E. - *Sternechus vicinus*. $11 + \bar{X}y_p$, 2337x. F. - *Anthonomus eugeni*. $14 + X_1 X_2 y$. Arrowheads point to the three sex chromosomes. 4453.

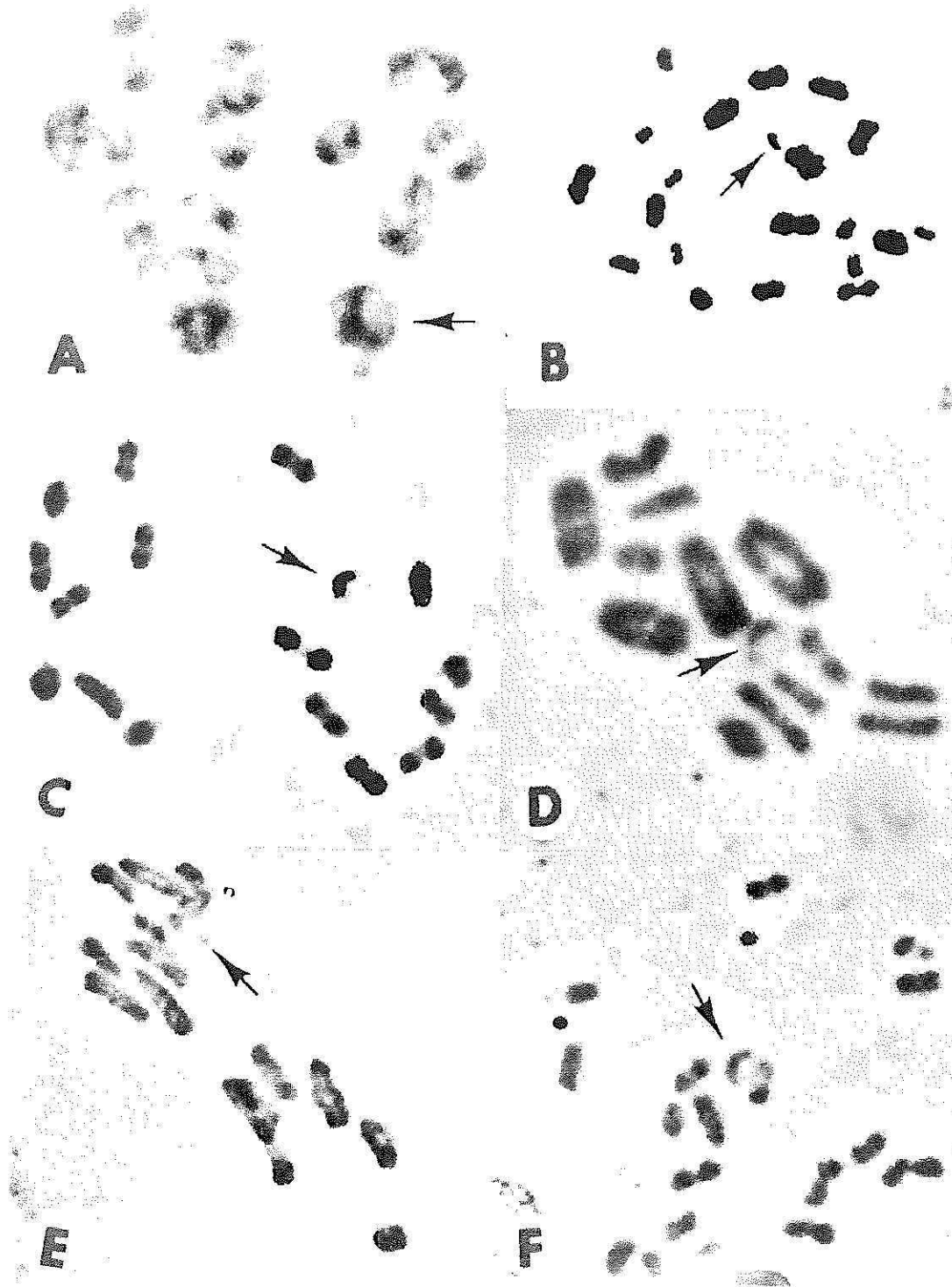


FIGURE 4. A to F. First meiotic division of male. Arrow points to the sex bivalent. A. - *Anthonomous flavus* 11 + Xy_p, 4453x. B. - *Conotrachelus sapotae*. 20 + Xy, 2507x. C. - *Sternocaelus* sp. 16 + Xy_p, 2507x. D. - *Peridinetus signatus*. 13 + Xy, 2507x. E. - *Cosmopolites sordidus*. 14 + Xy_p, 2507x. F. - *Cossonus hamiltoni*. 17 + Xy_p, 2507x. For silver stain reaction of this Xy_p, see Virkki et al., 1991.

Lachnopus seini, *L. yaucona* and *L. coffeae montanus* all are synonymized with *L. coffeae*, because we have encountered neither morphological nor cytological evidence to validate these taxa. In view of the chromosomal monotony of Phyllobiini, the elevated chromosome number ($16 + Xy_p$) in *L. kofresi* from Mona Island is most intriguing.

The autosomal numbers of Anthonomini vary from 11 to 20 pairs (Bárcenas, 1992; and this present list). The notorious cotton pest, *A. grandis*, has been the subject of the most detailed studies. Wise et al. (1982) and especially Bárcenas (1992) have produced abundant evidence in favor of an $X_1X_1X_2X_2/X_1X_2y$ sex chromosome system, whereas North et al. (1981) reported an Xy_p . Apparently, $20 + X_1X_2y_p$ (y_p because the parachute association mode seems to be retained: Bárcenas, 1992) is the correct meioformula.

Our determination of $14 + X_1X_2Y$ for *A. eugenii* agrees with that of Bárcenas (1992). The sex chromosomes of *A. flavus* are very different in size; their mode of association remains obscure.

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