

**Case 3772 – *Anastrepha* Schiner, 1868 (Insecta, Diptera, TEPHRITIDAE):
Proposed precedence over *Toxotrypana* Gerstaecker, 1860**

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Abstract. The purpose of this application under Article 23.9.3 of the Code is to conserve the current usage of the well-established genus-group name *Anastrepha* Schiner, 1868 for a genus of Neotropical fruit flies by reversal of precedence with its senior synonym, *Toxotrypana* Gerstaecker, 1860, under the plenary power of the Commission, in the interest of nomenclatural stability. Recent morphological and molecular studies demonstrate that the two genera are synonyms, however, while only one species of *Toxotrypana* is an agricultural pest, the multiple major pest species currently placed in *Anastrepha* have far greater impact on numerous commercial and subsistence fruit crops. The synonymy will involve changing their names and this would cause tremendous nomenclatural instability and disrupt scientific research and communication regarding their taxonomy, basic biology, management, and regulation.

Keywords. Nomenclature; taxonomy; Insecta; Diptera; TEPHRITIDAE; Neotropical fruit flies; *Anastrepha* Schiner, 1868; *Toxotrypana* Gerstaecker, 1860.

1. *Toxotrypana* Gerstaecker, (1860: 191) was proposed as a genus of true fruit flies (Insecta, Diptera, TEPHRITIDAE) with *Toxotrypana curvicauda* Gerstaecker, 1860 as type species by monotypy. It is a well-defined monophyletic group restricted to the New World tropics and subtropics. It currently includes seven valid species and a similar number of undescribed species (Norrbon et al., 1999a, 1999b).

2. *Anastrepha* Schiner, (1868: 263) also was proposed as a genus of true fruit flies (Insecta, Diptera, TEPHRITIDAE) with *Dacus serpentinus* Wiedemann, 1830 as type species by original designation. It is the largest genus of TEPHRITIDAE in the New World, including nearly 300 valid species (Norrbon et al., 1999a, 2012, 2015), with additional new species in the process of description (Norrbon, unpublished data).

3. Both genera include economically important species. *Toxotrypana curvicauda*, commonly known as the papaya fruit fly, is an important pest of papaya (*Carica papaya* L.) in the circum-Caribbean area (White & Elson-Harris, 1992; Norrbom, 2004). It is invasive in Florida (Weems, 1969). The other species of *Toxotrypana* are not considered to be economically significant.

4. Multiple species of *Anastrepha*, including the *A. fraterculus* (Wiedemann, 1830) complex (South American fruit fly), *A. grandis* (Macquart, 1846) (South American cucurbit fruit fly), *A. ludens* (Loew, 1873) (Mexican fruit fly), *A. obliqua* (Macquart, 1835) (West Indian fruit fly), *A. serpentina* (Wiedemann, 1830) (sapote fruit fly), *A. striata* Schiner, 1868 (guava fruit fly), and *A. suspensa* (Loew, 1862) (Caribbean fruit fly) are major pests, impacting commercial and subsistence crops such as citrus, guava, mango, melon, and many others (White & Elson-Harris, 1992; Norrbom, 2004). *Anastrepha fraterculus*, *A. ludens*, *A. obliqua* and *A. suspensa* (but not *Toxotrypana curvicauda*) are among the 20 species of fruit flies listed as quarantine pests by EPPO (2017). Numerous other species are minor or potential pests; eight other species are treated as pests by White & Elson-Harris (1992) and various additional species could be considered of similar status. Several species are invasive, including *A. fraterculus* (Brazil-1 type in Argentina, Bolivia and Peru), *A. grandis* (Panama), *A. ludens* (Panama), and *A. suspensa* (Florida) (Weems, 1965, 1966; Sutton et al., 2015). Although few detailed evaluations of their economic costs are available, Dowell & Wange (1986) estimated the annual economic costs (crop losses + control costs) of the establishment of *A. suspensa* or *A. ludens* in California alone would be more than \$84 million and more than \$107 million, respectively, and Erickson et al. (2000) estimated the impact of widespread establishment of *A. ludens* in the United States at \$927.75 million. To ensure safe trade, fruit exporting countries must maintain extensive trapping programs for *Anastrepha* pests in compliance with International Standards for Phytosanitary Measures of the International Plant Protection Convention (Jang et al., 2014). Virtually all fruit exporting countries in tropical and subtropical areas maintain extensive trapping programs to detect *Anastrepha* and other fruit fly pests. The Sterile Insect Technique has been applied to exclude *A. ludens* from California and Texas, to suppress *A. suspensa* in Florida, and to eradicate *A. ludens* and *A. obliqua* from northern Mexico (Orozco-Dávila et al., 2017). It is also being developed for use against *A. fraterculus* in South America. These multimillion dollar projects involve the construction and operation of factories to mass rear and sterilize fly adults, and additional manpower to disperse the flies and monitor the results.

5. *Anastrepha* and *Toxotrypana* together form a well-defined monophyletic group supported by both morphological (Norrbon et al., 1999b) and molecular studies (Han & McPheron, 1997; McPheron et al., 1999; Segura et al., 2006; Han & Ro, 2009; Mengual et al., 2017). Based on previous studies, *Toxotrypana* was well supported as monophyletic, but

the status of *Anastrepha* has been uncertain. Some studies suggested that *Anastrepha* might be paraphyletic with respect to *Toxotrypana*, but were not conclusive due to limited taxon sampling or insufficient character evidence (McPherson et al., 1999; Norrbom et al., 1999b; Barr et al., 2005). Recently, however, Mengual et al. (2017) investigated relationships within the *Anastrepha/Toxotrypana* clade, utilizing sequence data from six DNA regions in a total of 150 species. Their results conclusively demonstrate that *Toxotrypana* arises from within *Anastrepha*, confirming that *Anastrepha* as currently defined is paraphyletic with respect to *Toxotrypana*. *Toxotrypana* is the sister group of the *cryptostrepha* clade of *Anastrepha*, and this lineage is sister to the *tripunctata* group of *Anastrepha* (*taxa sensu* Norrbom et al., 2012).

6. *Anastrepha* and *Toxotrypana* thus should be recognized as subjective synonyms. Although *Toxotrypana* has priority, *Anastrepha* has far greater economic importance and treating the latter as a synonym of *Toxotrypana* would cause tremendous nomenclatural instability and disrupt scientific communication regarding multiple major pest species. Searches on January 10, 2018 using the USDA DigiTop Navigator (<https://dtnav.nal.usda.gov/>), which accesses the AGRICOLA, AGRIS, BIOSIS, CABI, EBSCO Environment, Scopus, Web of Science, Wildlife & Ecology, Zoological Record, and additional databases, for publications in the years 2008–2017 found 535 with *Anastrepha* in the title, but only six publications with *Toxotrypana* in the title. Searches for these years found 952 publications with *Anastrepha* in the title, key works or abstract, versus 16 for *Toxotrypana*. Searches without time restrictions found 1986 publications with *Anastrepha* in the title and 62 with *Toxotrypana* in the title, and 3977 with *Anastrepha* in the title, key works or abstract, versus 169 for *Toxotrypana*. The results of these searches indicate that the literature using the name *Anastrepha* is much vaster than that using the name *Toxotrypana*, and that changing the name of the former would cause serious problems in communication about these agriculturally significant flies. Norrbom et al. (submitted) propose the synonymy of these two names and the usage of *Anastrepha* as the valid name, along with new combinations of species names and a replacement name resulting from the synonymy, but action by the Commission is needed to validate this usage.

7. The International Commission on Zoological Nomenclature is accordingly asked:
- (1) to use its plenary power to give the name *Anastrepha* Schiner, 1868, precedence over the name *Toxotrypana* Gerstaecker, 1860, whenever the two are considered synonyms;
 - (2) to place on the Official List of Generic Names in Zoology the following names:
 - (a) *Anastrepha* Schiner, 1868 (gender: feminine), type species by original designation: *Dacus serpentinus* Wiedemann, 1830, with the endorsement that it is to be given precedence over *Toxotrypana* Gerstaecker, 1860, whenever the two are considered synonyms;
 - (b) *Toxotrypana* Gerstaecker, 1860 (gender: feminine), type species by monotypy: *Toxotrypana curvicauda* Gerstaecker, 1860, with the endorsement that it is not to be given precedence over *Anastrepha* Schiner, 1868, whenever the two are considered synonyms;
 - (3) to place on the Official List of Specific Names in Zoology the following names:
 - (a) *serpentinus* Wiedemann, 1830, as published in the binomen *Dacus serpentinus*, specific name of the type species of *Anastrepha* Schiner, 1868;
 - (b) *curvicauda* Gerstaecker, 1860, as published in the binomen *Toxotrypana*

curvicauda, specific name of the type species of *Toxotrypana* Gerstaecker, 1860.

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