
Taxonomic notes on the genus *Endoxylina* (Diatrypales, Ascomycotina) and description of a new species from Mexico

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Endoxylina tehuacanensis is proposed as a new species in the Diatrypales (Ascomycotina). The specimens were collected upon fallen branches of *Acacia constricta* (*Leguminosae*) in the southeastern part of the state of Puebla, Tehuacan valley, Mexico. A description and illustrations of the morphological characters of this new species are provided. Moreover a brief review all species belonging to *Endoxylina* is presented.

Key words: *Endoxylina*, Mexico, new species.

Introduction

The Diatrypales comprise approximately 200 species (Hawksworth *et al.*, 1995) whose diversity is best represented by the genera *Eutypa*, *Eutypella*, *Diatrype*, and *Diatrypella* (26, 70, 56, and 32 species, respectively). Following these four genera are the less diverse *Cryptosphaeria* and *Leptoperidia* (4 species each), and *Dothideovalsa*, *Echinomyces*, and *Fassia* (3, 2, and 1 species, respectively).

Romell (1892) first proposed *Endoxylina* as part of the Diatrypales when he assigned *Eutypa astroidea* as the type species for this new genus (also see Müller, 1962; Mhaskar, 1972; Sivanesan, 1977; Rappaz, 1987; Ju Ming *et al.*, 1996). Historically, as many as 10 species have been assigned to *Endoxylina* (Sawada, 1959; Müller, 1962; Müller and von Arx, 1962; Mhaskar, 1972; Sivanesan, 1977), although some of these have since been transferred to other synonymous genera (Ellis and Everhart, 1892; Wehmeyer, 1975; Rappaz, 1987; Barr, 1993). This situation has led to a great deal of taxonomic uncertainty and nomenclatural instability, both for the genus and for the species that comprise it (Hawksworth *et al.*, 1995). In a recent attempt to resolve this problem, Ju *et al.* (1996) argued that the presence of cruciform ostioles on the perithecia, along with the characteristically dark, septate, oblong-allantoid spores, are sufficient reasons to ratify the genus *Endoxylina* within the order Diatrypales.

Notwithstanding the current agreement among specialists over the placement of *Endoxylina* within order Diatrypales, the number of species recognized for this genus is not well established. For example, Sivanesan (1977) discusses 9 of the 10 species of *Endoxylina* currently mentioned in the literature and, based upon ascospore morphology, separates these species into two main groups. The first group is defined by species having ellipsoid to fusoid or ovoid ascospores (4 species: *E. citricola* Ou, *E. dilabentispora* Farlow, *E. indica* Mhaskar and *E. mori* Sawada), and the second is comprised of species with cylindrical to allantoid ascospores (5 species: *E. pini* Sivanesan, *E. astroidea* (Fr.:Fr.) Romell, *E. anserina* (Pers.:Fr.) E. Müller, *E. crocea* Kirsch and *E. polyspora* E. Müller). In addition, Shoemaker and Egger (1982) recorded *E. allantospora* (Ellis & Everh.) Shoemaker & Egger from Canada, which falls with little difficulty among the species with allantoid ascospores (Table 1). Sivanesan's scheme clearly points out the importance of the ascospores in defining species groups. However, I would further suggest that variation in ascospore morphology is one of the principal causes for the frequent placement of *Endoxylina* among other genera. The presence of such characters as ovoid ascospores, marked septal constrictions (e.g., in *E. indica*), and multisporeous asci (e.g., *E. polyspora*) suggest that at least 5 species, previously included among the *Endoxylina*, should be counted among genera such as *Valsa* and/or *Pseudovalsaria*. This topic certainly deserves greater attention. As a consequence a study of *Endoxylina* and similar genera is part of an ongoing investigation.

In this present study, a new taxon collected from the desert region of eastern central Mexico was easily placed within the *Endoxylina* because of several common characteristics, including: (1) darkly coloured spores, (2) flattened stromata, and (3) radially arranged openings along the ostioles of the perithecia. However, these typical morphological features were also accompanied by some unexpected characteristics, including: (4) large, triseptate spores, (5) asci with basal portions much shorter than the spore-bearing regions, and (6) the location of the perithecia in the cambium of the host. These unusual characters made it impossible to assign the Mexican material to any species previously ascribed to the genus. Accordingly, it seemed more likely that this material instead represented a new species of *Endoxylina*, which is formerly proposed and described below.

The Mexican material described herein as *Endoxylina tehuacanensis* came from the Tehuacán Valley, in the southeast-central region of Mexico, near Zapotitlán, Puebla. All samples were studied and deposited in the herbarium of the Instituto de Ecología (XAL) in Xalapa, Veracruz, Mexico. These specimens were also compared with generic and specific descriptions for

Table 1. *Endoxylina* species grouped according to ascospore morphology.

Species with ellipsoid, subfusoid to ovoid ascospores	Species with cylindrical to allantoid ascospores *
<i>Endoxylina citricola</i> Ou	<i>Endoxylina astroidea</i> (Fr.:Fr.) Romell
<i>E. dilabentispora</i> Farlow	= <i>E. allantosporiformis</i> E. Müller & Amed
<i>E. indica</i> Mhaskar & Rao	<i>E. allantospora</i> (Ellis & Everh.) Shoemaker & Egger
<i>E. mori</i> Sawada	<i>E. anserina</i> (Pers.:Fr.) Müller
	<i>E. crocea</i> Kirschs
	<i>E. pini</i> Sivanesan
	<i>E. polyspora</i> E. Muller
	<i>E. tehuacanensis</i> sp. nov.

* modified of Sivanesan (1977)

Endoxylina species reported in the literature and personally counterchecked against holotypes on loan from other herbaria.

Endoxylina Romell Romell, L., in Bot. Not.: 173, 1892.

Also see Ju *et al.*, in Mycotaxon 58, p.438, 1996.

Stromata extend broadly beneath the bark of the host plant and embedded in the host cambium; emerging as valsoid or eutypoid scabs or pustules, either separated or joined by a confluence; surface dark gray with blackish spots attributable to the ostioles of the perithecia. *Perithecia* globose to subglobose, separated by host tissue, rarely joined, and monostichous. *Ostioles* (tip of the perithecial necks) black, conical, papillate, surrounded by a mixture of fungal and host plant tissues not very prominent and emerging separately, the apical portion containing 3-5 linear sulcations arranged radially. *Paraphysoid* elements present, hyaline, and septate. *Asci* persistent, unitunicate, and octosporous, claviform, becoming thinner toward the base and terminating in a long, slender stipe; At times they are not so pronounced as is the case in the majority of species in this group; their apical pore is inamyloid. *Ascospores* oblong ellipsoid to allantoid, light to dark brown normally symmetric but sometimes asymmetrics too; characteristically uni- to tri-septate; walls smooth and thick, regularly giving a false double-walled appearance.

Endoxylina tehuacanensis Chacón, sp. nov.

(Figs. 1-5)

Stromata plerumque indeterminatus, plus minus 1-3 cm longus prolongatus ab portionis inferiore ex corticis hospitis et cambium immersis, similis custra vel macula griseam, aspectus pulverulentus cum nigra punctata per ostiola, perithecia cum collum corticis perforatis. *Entostromata* crescens pauci, quando adsum dein circa ad ostiola. *Perithecia* 400-570 × 400-450 µm, globosus, subglobosus, distantes vel subdistantes cretus aut aliquando conjunctim, monostichis. *Ostiola* (collum ad perithecia) 200-250 × 100-150 µm, pauci conspicua, emersum discretus, portionis apicalis cum 3-4 fissurae linearis dispositionis radiata. *Asci* 60-80 × 11-15 µm in portionis fertilis, claviformis, apicis notabilis plus latus, basis terminatus in stipitatus

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subtilis, non major ad longi ad portionis qui comprehendo sporarum, porus apicalis conspicuus, inamyloidea. *Ascospores* (17-)19-22(-23) × 5-6 μm, allantoideae vel subcylindricae, brunneae quasi nigra, crassitunicatus verisimiliter bitunicatus; triseptatus, aliquando uniseptatus et biseptatus, irregulariter biseries intus ad asci.

In ramulus caducus ad *Acacia constricta* in vegetatio xerophilus.

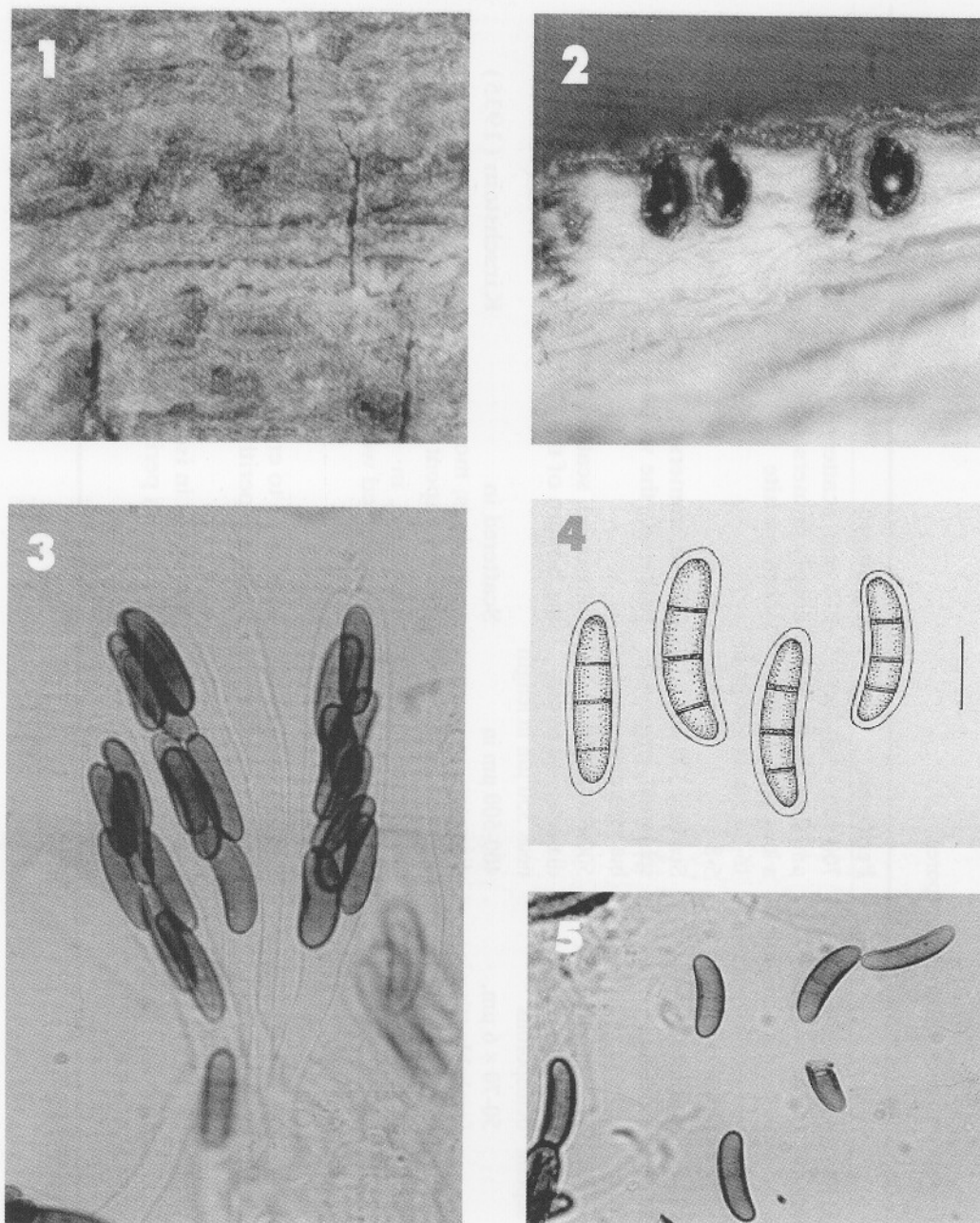
Stromata regularly indefinite, 1-3 cm long, extending beneath the bark of the host plant and into the cambium, appearing as dusty- or grayish scabs flecked with darkish spots, which correspond to the ostioles of the perithecia (i.e. the perithecial necks that extend into the host bark). *Entostroma* dark gray and poorly developed, and when present, occurring around the ostioles. *Perithecia* measure 400-570 × 400-450 μm, globose to subglobose, separate or occasionally joined, monostichous. *Ostioles* 200-250 × 100-150 μm, not very prominent, emerging separately, apical portion characterized by 3-4 linear openings that are radially arranged. *Asci* 60-80 × 11-15 μm at fertile end, claviform, being markedly apically wider terminating in a thin stipe that is not greater in length than the portion of the ascus containing the ascospores, apical pore conspicuous, inamyloid. *Ascospores* (17-)19- 22(-23) × 5-6 μm, allantoid to subcylindrical, brown to almost black in mass, having a thick wall, giving the appearance of a double walled structure, triseptate (occasionally only one or two septa are noted) and irregularly biserial within the asci.

Habitat: Growing on fallen branches of *Acacia constricta* in xerophyllic vegetation.

Material examined: MEXICO, Zapotitlan de las Salinas, Puebla, near the biological station operated by the Universidad Nacional Autónoma de México (UNAM), 13 Dec. 1997, *Chacón 5114-B* (holotype); *ibid.* 17 Apr. 1999, *Chacón 5127, 5136*, UNAM Botanical garden, 12 June 1999, *Chacón 5145* (all in XAL).

Other specimens examined: The following materials were compared with *E. tehuacanensis* and turned out to have great taxonomic affinity with this species. CANADA, *Cryptosphaeria eunomia* var. *faxini*; Ontario Ash, London; (NY-Ellis-holotype). SWITZERLAND, *Endoxylina astroidea* Roche, Vand; 5-3-1983, R-314 (in CBS as *Eutypa astroidea*; see also Rappaz, 1987). NORWAY, *Endoxylina anserina*; Ukjent lokalitet; paa Tilia, Vertsplante: Tilia, Nils Green Moe [O-63083; as *Valsaria anserina* (Pers.:Fr.) Sacc.].

Notes: Among the characteristics that distinguish *Endoxylina tehuacanensis*, the most important are: (1) flat stromata, (2) perithecia embedded in the host cambium, (3) triseptate ascospores, and (4) allantoid ascospores larger than those observed in other species of this genus. Among morphologically similar representatives of other genera, the species most likely to be confused with it is *Cryptosphaeria eunomia* (Fr.:Fr.) Fuckel var. *faxini* (Richon) F. Rappaz [which according to Ju Ming *et al.* (1996) should be included in the *Endoxylina*]. However, *C. eunomia* differs from *E. tehuacanensis* in having larger ascospores (16-30 × 4-6 μm), septa that vary from 1 to 3 to 5, and perithecia that develop separately, rather than growing together or being joined by a confluence. Of the species considered to belong



Figs. 1-5. Stereomicrograph, drawing and light micrographs of *Endoxylina tehuacanensis* (from *holotype*). **1.** Partial view of the stromatic surface illustrating sulcate ostiola. **2.** Vertical section through stroma illustrating perithecia and host tissue. **3.** Asci and ascospores. **4.** Drawing of the ascospores. **5.** Ascospores. Bars: 1 = 0.4 mm; 2 = 400 μ m; 3, 5 = 11.2 μ m; 4 = 7.5 μ m.

in *Endoxylina*, *E. citricola*, *E. dilabentispora*, *E. indica* and *E. mori* are herein rejected because they possess ellipsoid, fusoid, or ovoid ascospores, and they have only one septum (Table 1). Among species with allantoid ascospores (Tables 1, 2), *Eutypa astroidea* is characterized by stromata, asci, and

Table 2. A comparison of *Endoxylina* species with allantoid ascospores.

Species	Ascospores	Asci	Perithecia	Stromata	References
<i>E. allantospora</i>	(11.4-)13-18(-21.6) μm with a single median septum, (occasionally forming a second septum)	83-117 \times 8-14 μm , (probably stipe is included), octosporous, occasionally unisporous or bisporous	700-900 \times 500-700 μm , flask shaped with a long neck, 1200 \times 15-20 μm , in groups of 5-8	2-4 mm, scattered, deeply immersed, content white	Shoemaker and Egger, (1982)
<i>E. anserina</i> *	16-20 \times 6-7 μm , slightly constricted at the septum	Sporidia uniseriated inside asci	Scarcely 500 μm , sphaeroid, gregarious but separated	Effuse, immersed, blaking the wood	Ellis and Everhart (1892) as <i>Valsaria anserina</i>
<i>E. astroidea</i>	15-19 \times 4-5 μm , uniseptate, not constricted at the septum	50-100 \times 7-13 μm (only part with spores), octosporous	500-650 μm in diameter, sphaeroid, neck 350 μm in length	Immersed, scattered at the bottom of the bark	Rappaz (1987) as <i>Eutypa astroidea</i>
<i>E. crocea</i>	10-14 \times 2-3 μm , uniseptate, not constricted at the septum	50-70 \times 6 μm , (probably stipe is included), octosporous	400-500 μm in diameter	Scattered in acervulous, more or less errumpent	Kirschstein (1935)
<i>E. pini</i> *	13-15-17 \times 2.5-3(-4) μm , one septate, rarely bisepate, not constricted at the septum	50-60 \times 6-7 μm (only part with spores, octosporous)	780 \times 870 \times 300-550 μm , neck 260-600 \times 300-480 μm , in groups of 2-5	Immersed, in decorticated wood	Sivanesan (1977)
<i>E. polyspora</i> *	7-9 \times 2-3 μm , uniseptate, not constricted at the septum	60-70 \times 10-12 μm , probably stipe is included, multisporous	200-300 μm , globose to piriform, isolate	Immersed to errumpent in isolate perithecia	Müller (1962)
<i>E. tehuacanensis</i>	(17-)19-22(-26) \times 5-6 μm , triseptate, not constricted at the septum	(60-)70-80 \times 11-15 μm (part with spores) octosporous	400-570 \times 400-450, globose, necks 200-250 \times 100-150 μm , gregarious	Immersed in isolate to gregarious perithecia	

* Currently under *Endoxylina*, need further study.

perithecia that are very similar to *E. tehuacanensis*. However, in *Eutypa astroidea* the ascospores are smaller ($15-19 \times 4-5 \mu\text{m}$), having only one septum and their wall, while thick, does not give the appearance of a double-walled structure. Likewise, *Endoxylina allantospora*, *E. anserina*, *E. crocea*, *E. pini* and *E. polyspora*, show little affinity with *E. tehuacanensis* because they have uniseptate, allantoid ascospores that are also much smaller. Furthermore, it should be noted that: (1) the inferior portion of the asci of *Endoxylina tehuacanensis*, although narrower than the condition in other species examined, does not terminate in a filament characteristic of most species in this group; (2) the ascus pore, although conspicuous, is not as prominent as in *E. allantospora*; (3) the widest diameter of the ascus is slightly greater than that recorded for the known species of *Endoxylina*; and finally (4) the stromata of *E. astroidea* and *E. anserina*, although appearing very much like those in *E. tehuacanensis*, have more conspicuous perithecial ostioles, and consequently, have better defined apical openings.

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