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Chilo aleniellus (Lepidoptera: Pyralidae), a stem borer of maize in Côte d'Ivoire

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Abstract

The stem borer, *Chilo aleniellus* (Strand) (Lepidoptera, Pyralidae) is recorded for the first time as a pest of maize in the western part of the forest area of Côte d'Ivoire. Descriptions are given of the larva (including chaetotaxy), the pupa, and adult genitalia. The geographical distribution of this species is presented, and its importance as a pest in Côte d'Ivoire is discussed.

Introduction

During recent years, maize borers in Côte d'Ivoire have been studied by various authors. Pollet *et al.* (1978) identified four lepidopterous borers in the region of Abidjan (fig. 1). Of these, the pyralid *Eldana saccharina* Walker and the noctuid *Sesamia botanephaga* Tams & Bowden are borers of both stems and cobs. The remaining two species, *Cryptophlebia leucotreta* (Meyrick) (Tortricidae) and *Catopyla dysorphnaea* Bradley (Pyralidae) attack only the cobs. Dabiré-Binso (1980) reported the presence of other lepidopterous borers in Bouaké, in the central Côte d'Ivoire (fig. 1). These were the noctuids *Sesamia calamistis* Hampson and *Busseola fusca* (Fuller), and an undetermined cob borer which she supposed to be *Mussidia nigrivenella* Ragonot (Pyralidae). Moyal (1988a, 1988b) stressed the importance of maize borers for the whole of the savannah area of Côte d'Ivoire (fig. 1) and indicated that the borer reported as *Catopyla dysorphnaea* by Pollet *et al.* (1978) was a misidentification of *M. nigrivenella*.

As a result of these studies, six stem and cob borers of maize were already known from Côte d'Ivoire. However, no study has yet been carried out in the forest area, between the savannah and coastal areas. Recent researches in that region demonstrate the presence of a lepidopterous maize borer, *Chilo aleniellus* (Strand) (Pyralidae), previously unrecorded on maize in Côte d'Ivoire. The morphology, biology and economic importance of C. *aleniellus* in Côte d'Ivoire are studied in this paper.

Material and Methods

Populations of borers were studied either in observation plots or in control used for agronomic trials without insecticide treatments. The maize variety used was 'Composite jaune de Bouaké' (CJB), the most widely distributed variety in Côte d'Ivoire (CIDT, 1984). It has a growing season, from sowing to harvest, of about 100 days, and a maximum yield of 6200 kg/ha (IDESSA, 1982).

Depending on rainfall, the number of growing seasons in a year varies. In the northern and western parts of the country, with one rainy season a year, only one growing season is possible, beginning in May and June. In the central and southern regions, two rainy seasons permit the growing of maize twice a year. Observations were therefore carried out during one or two growing seasons in a year, depending on the region. Random samples of 100 plants per plot were made about every 20 days of the growing season.

The study localities varied in different years (table 1). During the first years (1982-84), sampling was carried out in the savannah area, and later (since 1986) in the forest area, while control plots were maintained in the savannah area.

The chaetotaxy of the larvae was studied by first immersing them in cold potash (KOH) for varying periods (1-4 days). Several authors have proposed systems for naming the primary setae (Dyar, 1901; Quail, 1904; Forbes, 1923; Fracker, 1929; Gerasimov, 1935; Janse, 1939; Hinton, 1946; Mutuura, 1956). We chose (as did Bourgogne (1951) and most authors (Stehr, 1987)) Hinton's classification, which defines body setae as dorsal, subdorsal, lateral, sub-ventral and ventral, and includes the microscopic setae (fig. 10).

Stehr (1987) proposed a slight modification of Hinton's system, concerning the head chaetotaxy. We have, however, maintained Hinton's method in order to facilitate comparison with previously published descriptions of other borers (Moyal & Tran, 1989).

Species were identified using Bleszynski's (1970) taxonomic revision of world *Chilo* species. The voucher specimens were deposited at the Museum National d'Histoire Naturelle de Paris (antenne ORSTOM).

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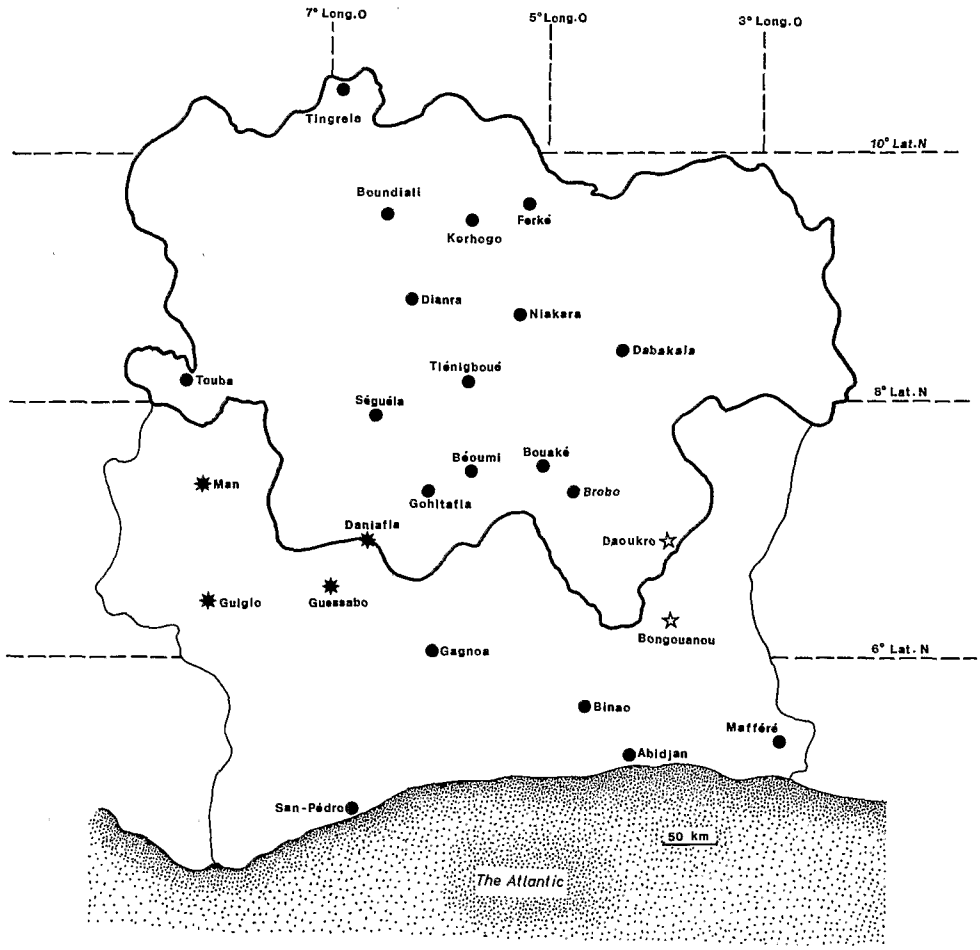

Fig. 1. Map of Côte d'Ivoire showing presence of *Chilo aleniellus*. Bold line: limits of the savannah area. ● : not present, ☆ : rare, ✻ : regularly occurs.

Results

Results obtained are presented in figs 1-27. *C. aleniellus* is regularly found only in the western part of the forest area (fig. 1). Population density was maximum in Man in 1986, with 33 insects in 100 plants at 74 days after emergence (d.a.e.), representing 20% of borers (fig. 27). During the following years, population density in that area was lower, with a regular occurrence of a maximum of 15-20 insects in 100 plants each year, representing 10 to 20% of borers. In the other localities, slightly further east (Daniafla, Guessabo and Guiglo) attacks were less frequent, with a maximum of five to six larvae in 100 plants, representing about 1% of borers.

In contrast to the western region where it is regularly present, *C. aleniellus* was rarely found in the eastern part of the forest region at approximately the same latitude (Bongouanou and Daoukro). In Bongouanou, in August 1988, at 80 d.a.e., two larvae were found in 100 plants, representing 0.7% of borers. In Daoukro, at the end of July 1989, at 40 d.a.e, 0.6 larvae were found in 100 plants representing 0.13% of borers.

C. aleniellus generally commences feeding at the end of the growing season, during the milky stage of maize, at about 60 d.a.e. and attacks primarily the stems (80% of larvae were in the stems, and 20% in the cob). Earlier attacks may however occur at 40 d.a.e. The larval cycle lasts about 30 days, and pupation lasts 11 to 12 days at 22°C. No parasitoids of this species have yet been recorded, although Jordan (1966) recorded *Apanteles* sp. near *laevigatus* (Ratzeburg) (Hymenoptera; Braconidae) from *C. aleniellus* on rice in Sierra Leone.

The larva (figs 2-15) can be easily distinguished from those of other borer species in Côte d'Ivoire by its large brown pinacula and chaetotaxy. The second thoracic segment, with two long sub-ventral setae (one only for the other borers), presents a total of 10 long setae, which we found in no other maize borer (Moyal & Tran, 1989).

Ventral prolegs are of the circle type; caudal prolegs are of the mesoseries type. The head chaetotaxy is characterized by very small adfrontal setae, which are extremely difficult to see unless the head is orientated antero-posteriorly, with the mouthparts foremost.

The pupa (figs 16-19), has no special structures on either the cephalothorax or abdomen, and presents an

Table 1. Localities in Côte d'Ivoire and years of studies.

	1982	1983	1984	1986	1987	1988	1989
Tingrela	x	x					
Boundiali	x	x					
Korhogo			x				
Ferké						x	x
Touba	x	x	x				
Séguéla		x	x				
Dabakala	x						
Tienigboué	x	x					
Dianra	x	x					
Béoumi		x	x				
Gohitafla	x	x	x				
Daoukro	x		x				
Niakara		x	x				
Gagnoa				x	x	x	x
Man				x	x	x	x
Guessabo						x	
Daniafla					x		
Guiglo						x	
Maffere						x	
San-Pedro						x	
Binao						x	
Adiopodoumé				x			
Bongouanou					x	x	
Bouaké	x	x		x	x	x	x
Brobo					x	x	

abrupt narrowing at the level of the eighth abdominal segment. The cremaster bears four small spines dorsally.

The male and female genitalia are shown in figs 20-26.

Discussion

The larvae of the 43 species of *Chilo* recognized by Bleszynski (1970) are all stem borers, and some among these are mentioned as borers of maize. *C. partellus* (Swinhoe) is a well known pest of maize in Asia, East Africa, and, more recently, South Africa. *C. orichalcociliellus* (Strand) occurs in East, central and southern Africa and in Madagascar (Bleszynski, 1970; Delobel, 1975b; Scheltes, 1978; Warvi & Kuria, 1983). *C. agamemnon* Bleszynski occurs in Egypt, Israel, Sudan and Uganda (Bleszynski, 1970; Delobel, 1975b; Melamed-Madjar *et al.*, 1987). *C. diffusilineus* (J. de Joannis) is widely distributed in Africa (West Africa, Ethiopia), (Bleszynski, 1970) and attacks maize in Burkina-Faso (Bonzi, 1982). *C. zacconius* Bleszynski is present in West Africa and is also mentioned by Bleszynski (1970) as a maize borer. It is worthy of note that the last two species mentioned are pests of rice in Côte d'Ivoire, and are not known to attack maize.

Other *Chilo* species which are secondarily maize borers include *C. suppressalis* (Walker), *C. polychrysus* (Meyrick), mainly rice pests, and *C. infuscatellus* Snellen, primarily a pest of sugarcane (Kranz *et al.*, 1977; Wyniger, 1962).

We have been unable to find any reference to *C. aleniellus* as a maize borer. This species is mentioned as a rice borer in Sierra Leone (Jordan, 1966) and Côte d'Ivoire (Tavakilian, 1977; Tran, 1977, 1981) and was also found in *Pennisetum subangustum* in Sierra Leone (Jordan, 1966). Its distribution stretches from West to central Africa, including Sierra Leone, Côte d'Ivoire, Ghana, Nigeria, Cameroon, Congo and Uganda (Jordan, 1966; Bleszynski, 1970). Bleszynski (1970), however, pointed out some important differences between West and central African populations, indicating the possibility of two species being present.

In Côte d'Ivoire, we found this species only in the forest area, or very close to it at Daoukro. Tavakilian (1977) recorded it in Beoumi, in the southern part of the savannah area. The distribution of *C. aleniellus* in Côte d'Ivoire may therefore be considered to occur between latitudes 6° and 8° N. Appreciable population densities, however, are found only in the western part of the forest area, particularly in Man, where *C. aleniellus* regularly represents 10-20% of maize borers. Population density rapidly decreases moving eastwards.

Principal attacks of this pest occur at the end of the growing season, when its behaviour can be likened to that of *Eldana saccharina*. When attacks occur earlier, *C. aleniellus* behaves in a manner similar to *B. fusca*; larvae first attack the whorl leaves, producing 'windowpane' damage, before entering the stem. This type of behaviour at the beginning of the growing season is frequently encountered in *Chilo* spp. (Delobel, 1975b).

The morphological study presented here permits easy distinction between *C. aleniellus* and other maize borers studied by Moyal & Tran (1989, 1991). *C. aleniellus* is, however, closely related to *C. orichalcociliellus*, a species also attacking maize, and the distributions of these species overlap in central Africa. The morphological proximity of the adults is also reflected in the larvae. The body chaetotaxy of some segments of the larva of *C. orichalcociliellus* figured by Mathez (1972) and Delobel (1975a) is similar to that of *C. aleniellus* with respect to the long setae. Only the microscopic setae, which are much more difficult to observe, differ in number. In comparison with Delobel's (1975a) descriptions, *C. aleniellus* bears an additional two microscopic setae on the second thoracic and third abdominal segments, and one more on the seventh abdominal segment (among the segments figured by Delobel). Compared with Mathez's (1972) descriptions, *C. aleniellus* has only one more ventral microscopic seta on the second thoracic segment (only the second thoracic and first abdominal segments are described by Mathez). In addition to these differences, the head of *C. aleniellus* bears very small adfrontal setae, which are apparently absent in *C. orichalcociliellus* (based on figures by Delobel, 1975a). Mathez's (1972) study also permits the larva of *C. partellus* to be distinguished from that of *C. aleniellus*.

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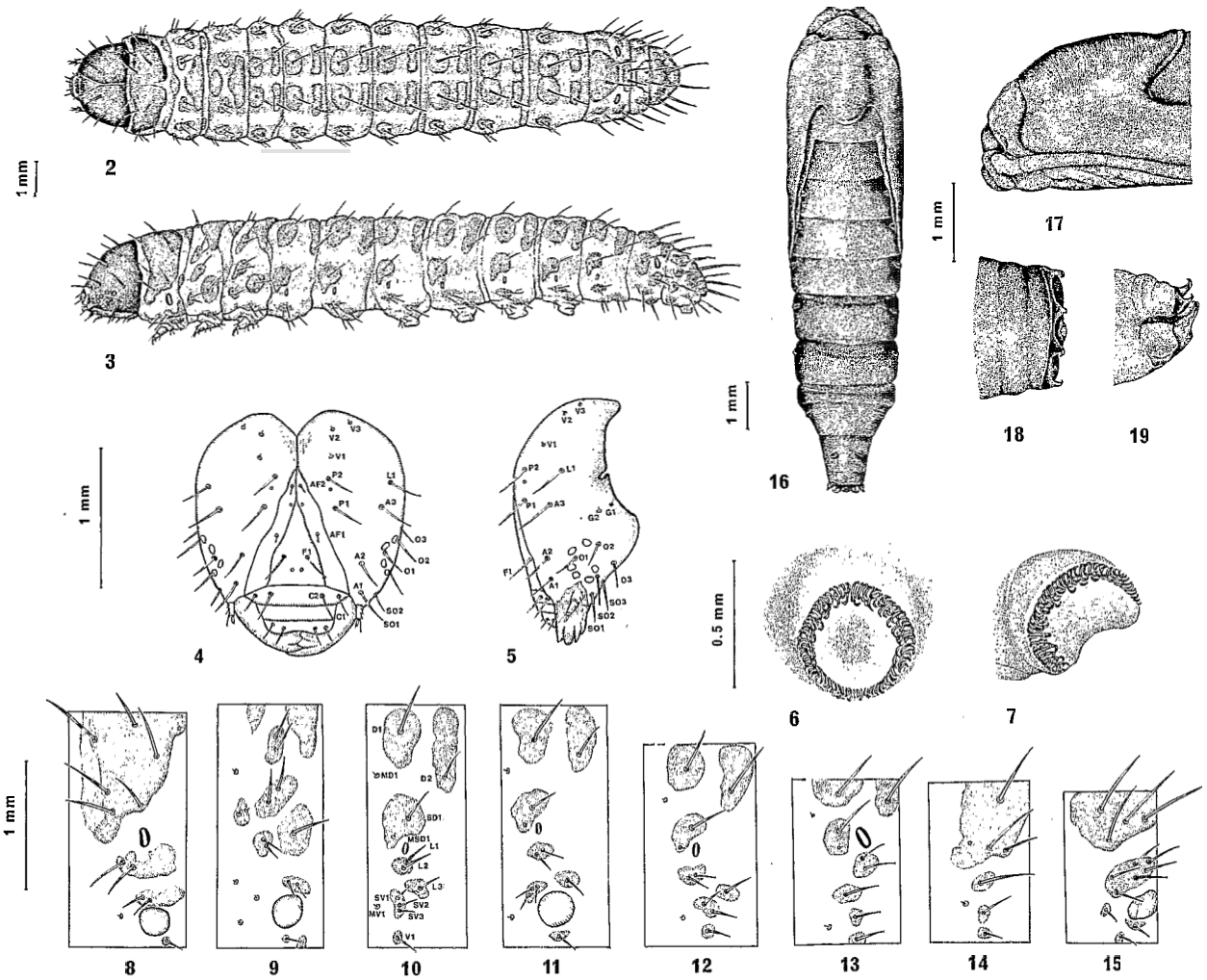

Figs 2–19. Figs 2-3, the larva of *C. aleniellus*: 2, dorsal view; 3, lateral view. Figs 4-5, the head chaetotaxy of the larva of *C. aleniellus*: 4, anterior view; 5, lateral view. Setae: A: anterior; AF: adfrontal; C: anteclypeal; F: frontal; G: genal; L: lateral; O: ocellar; P: posterior; SO: sub-ocellar; V: vertical. Fig. 6-7, prolegs: 6, ventral proleg; 7, caudal proleg. Figs 8-15, the body chaetotaxy of the larva of *C. aleniellus*: 8-9, 1st and 2nd (=3rd) thoracic segments; 10-15, 1st (=2nd), 3rd (=4th, 5th, 6th), 7th, 8th, 9th and 10th abdominal segments. Setae: D: dorsal; L: lateral; MD: microscopic dorsal; MSD: microscopic sub-dorsal; MV: microscopic ventral; SD: sub-dorsal; SV: sub-ventral; V: ventral. Figs 16-19, the pupa of *C. aleniellus*: 16, general dorsal view; 17, profile view of cephalothorax; 18, dorsal view of cremaster; 19, profile view of cremaster.

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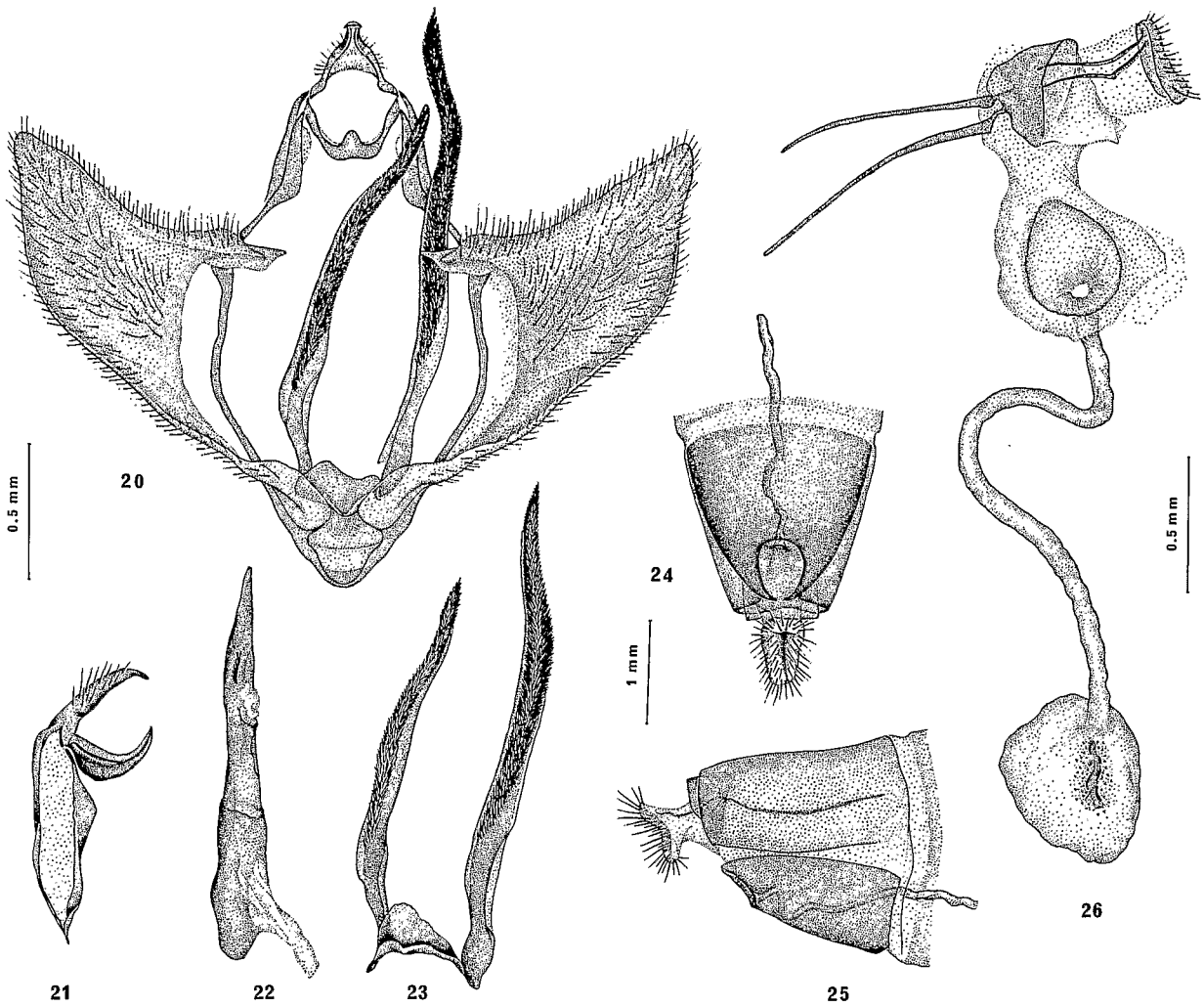

Figs 20-26. Fig. 20, male genitalia of *C. aleniellus*: general ventral view (penis removed). Figs 21-23, male genitalia of *C. aleniellus*: 21, profile view of uncus, tegumen and gnathos; 22, penis; 23, inferior fultura. Figs 24-25, female abdominal end: 24, ventral view; 25, lateral view. Fig. 26, female genitalia of *C. aleniellus*: general view.

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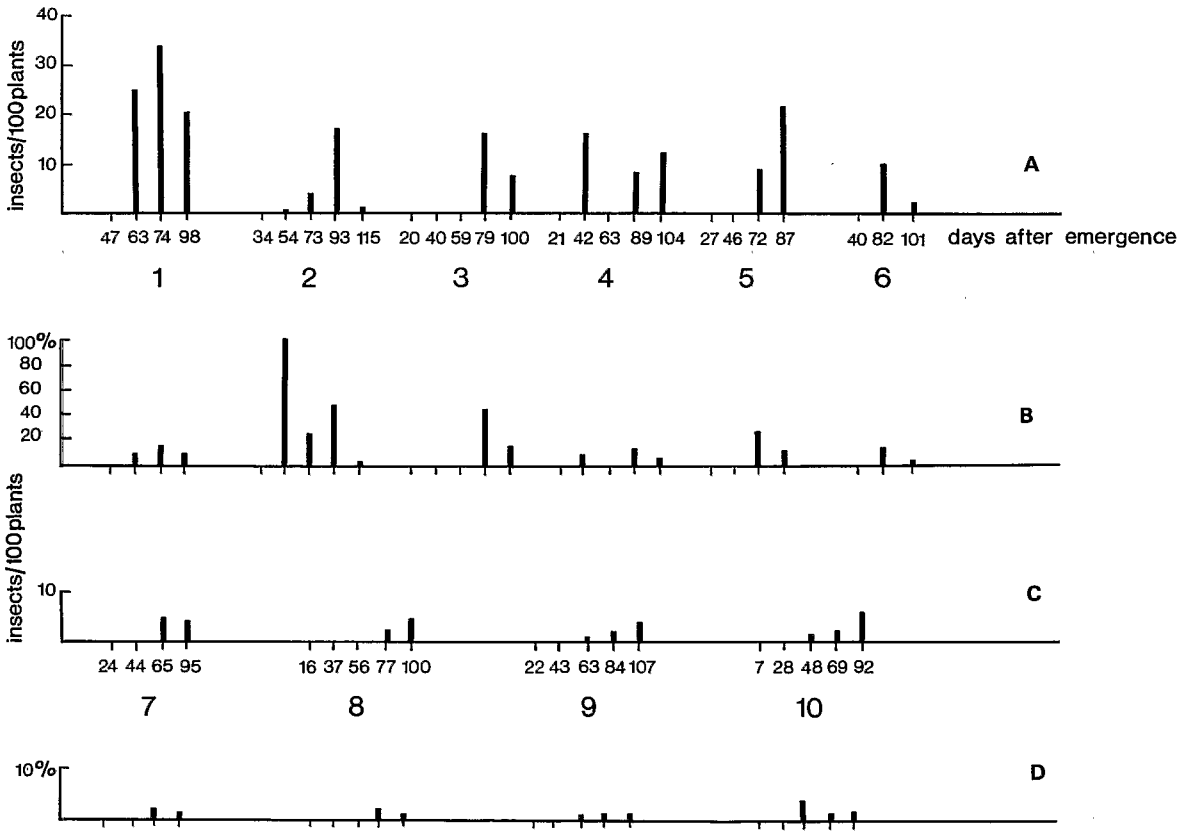

Fig. 27. Population density of *C. aleniellus* (A & C) and percentage of *C. aleniellus* among other borers (B & D). 1 to 6: Man: 1986; 1987 (2 trials sown at interval of 15 days); 1988 (2 trials sown at interval of 15 days); 1989. 7 to 10: Daniafla, 1987; Guessabo 1988; Guiglo 1988 (2 trials sown at interval of 15 days).

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