

A New Species of *Ceratitis* (*Ceratitis*) (Diptera: Tephritidae), Key to Species of Subgenera *Ceratitis* and *Pterandrus*, and Record of *Pterandrus* Fossil

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ABSTRACT

A key to males of *Ceratitis* (*Ceratitis*) and *Ceratitis* (*Pterandrus*), including the fruit pests *C. (C.) capitata* (Wiedemann) and *C. (P.) rosa* Karsch, is given. *Ceratitis* (*Ceratitis*) *brachychaeta*, n. sp., from Tanzania is described. *Ceratitis* (*Pterandrus*), probably *rosa* Karsch, is the 1st tephritid fossil in amber to be recorded.

INTRODUCTION

The tribe Ceratitini needs revision. The classification is unsound, and the phylogeny has never been studied. Phylogenetic relationships with other Trypetinae, such as the Gastrozonini, which are similar in appearance and possibly related (Hancock 1985), likewise are not understood. A notable deficiency in the ceratitine literature is the lack of modern keys identifying the described species of the larger genera and subgenera, particularly *Carpophthoromyia* Austen, *Ceratitis* MacLeay (including the subgenera *Ceratalaspis* Hancock, *Pardalaspis* Bezzi, and *Pterandrus* Bezzi), *Perilampsis* Bezzi, and *Trirhithrum* Bezzi.

The tribe Ceratitini is large, with about 160 described (e.g., Cogan & Munro 1980) and many undescribed Afrotropical species and several Oriental, Australian, and Palearctic species. The tribe contains several agricultural pests that are notorious, including the most economically important tephritid, the Mediterranean fruit fly or Medfly, *Ceratitis capitata* (Wiedemann). Size alone would render a comprehensive revision of the tribe difficult. Therefore, it was considered more feasible to first address specific and restricted problems and taxa within the tribe. This paper attempts to remedy the deficiency in keys for species of the subgenera *Ceratitis* and *Pterandrus* of the genus *Ceratitis*.

Among all ceratitines, males of the subgenera *Pterandrus* and *Ceratitis* characteristically have distinctive setal ornamentation of the legs, which give them a bushy or featherlike appearance. The leg ornamentation in *Pterandrus* is generally black, whereas that of *Ceratitis* is yellow. Male *Ceratitis* are further characterized by: (1) yellow and often blunt or strongly capitate (= spatulate) orbital setae, (2) arista with short rays mostly dorsobasally, but a few rays may be present ventrobasally, (3) black and yellow mesonotal pattern, including a distinct round or triangular black spot on the mesal end of the transverse suture, (4) very wide wing, length-width ratio about 1.8, and (5) golden yellow wing bands bordered by brown. Male *Pterandrus* are further characterized by: (1) usually plumose arista with moderately long rays both dorsally and ventrally, (2) dull gray or brown scutum, which in many species does not have a well-defined, contrasting spot on the mesal end of the transverse suture, and (3) usually brown to black wing

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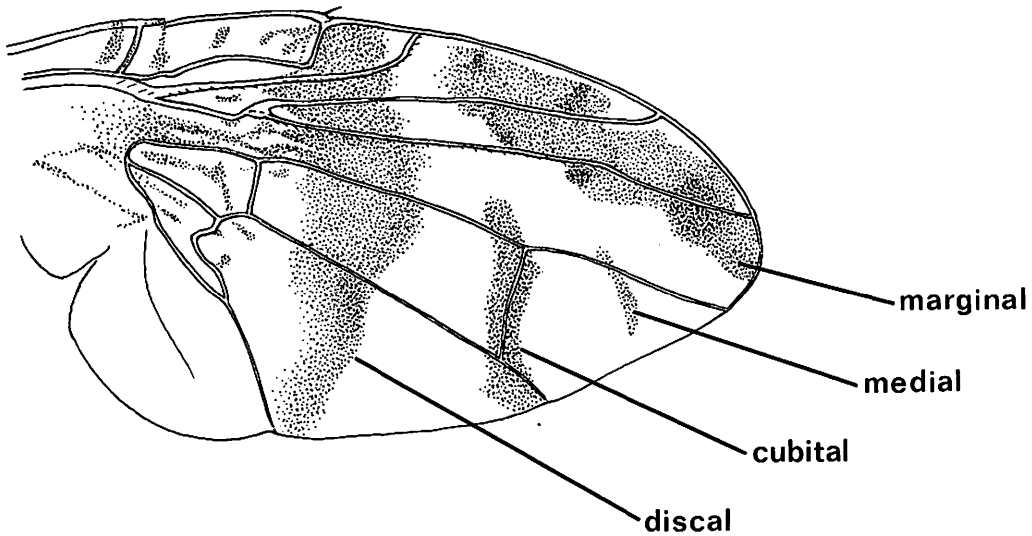


Fig. 1. *Ceratitis*, wing, semidiagrammatic, with terminology of bands as used in the text.

bands. Some species do not fall completely within the limits of either of these subgenera, indicating intergradation that may eventually necessitate synonymizing the 2 names. However, the possibility of such synonymy should be considered in the context of a revision of all pertinent taxa.

METHODS AND TERMINOLOGY

The keyed species follow Hancock's (1984) classification of the subgenera and species of *Ceratitis*, with the following exceptions: (1) *antistictica* Bezzi is considered a species of *Ceratitis* (*Ceratalaspis*) not *Ceratitis* (*Ceratitis*) (males do not have modified orbital setae) and therefore is not included and (2) *gravinotatus* Munro is retained in *Ceratitis* (*Pterandrus*). Males of *C.* (*Ceratitis*) *manjakatampo* (Hancock 1984:283) are not known, and the species could not be included in the key. The key is based mainly on secondary characters of males and occasionally wing and other characters. For the construction of the key all relevant specimens in the collections of the National Museum of Natural History, Washington, D.C., and Tel Aviv University were checked, as well as several specimens housed in The Natural History Museum, London, and Plant Protection Research Institute, Pretoria. Identified males of all the species were studied.

The following terms are used in the key:

Wing bands (Fig. 1): **Discal**—a more or less complete transverse band across basal half or middle of cell dm. **Cubital**—a transverse band over crossvein dm-cu. **Medial**—an oblique band or streak over distal section of vein M. **Marginal**—a band along the costa from about pterostigma to about end of vein M. Two or more bands may be connected or separate ("free").

Legs: **Bushy**—densely ornamented by numerous setae of various lengths, generally not arranged in recognizable rows. **Feathered**—ornamented by 1 or more, often opposing, rows of unusually broadened and dense setae. The last 2 characters are not completely unequivocal; therefore, some confusion might occur, especially in deciding whether the foreleg is bushy or not (couplet 9 in the key). In doubtful cases, try both alternatives.

Key to Males of *Ceratitis* (*Ceratitis*) and *Ceratitis* (*Pterandrus*)

1. Anterior orbital seta modified, not black and acuminate; forefemur bushy, with setae yellow or mostly yellow; other legs neither feathered nor bushy; arista usually not plumose, with

- relatively few short rays; mesonotal pattern usually elaborate, with shiny black areas contrasted with yellow and gray (microtomentose) areas; wing pattern usually partly golden yellow . . . (subgenus *Ceratitis* s. str.) 2
- Anterior orbital seta black and acuminate, unmodified (in *C. (P.) tananarivana* there are occasionally 3, unmodified, orbital setae); midleg usually feathered or otherwise ornamented by setae; foreleg and hind leg sometimes feathered or bushy; feathering usually black; arista usually plumose; mesonotal pattern usually dull, with less contrasted scutal pattern; wing pattern usually brown to black . . . (subgenus *Pterandrus*) 8
2. Anterior orbital seta strongly widened distally (spatulate), forming a distinct plate (palette) . . . 3
Anterior orbital seta not strongly widened distally and not forming a distinct plate 6
3. Wing with a median band or streak 4
Wing without a median band or streak 5
4. Spatulate anterior orbital seta longer than arista, about as long as head height, with the palette about 1.5x as long as wide; cubital band connected to discal band; medial band free *catoirei* Guérin
Spatulate anterior orbital seta shorter than arista, about $\frac{2}{3}$ as long as head height, palette at least 2x as long as wide; cubital band free, medial band connected to marginal band *malgassa* Munro
5. Orbital plate extends beyond anterior edge of eye; spatulate anterior orbital seta longer, extended beyond arista, with the palette rounded; mesonotum generally paler, with microtomentum and general appearance yellowish *caetrata* Munro
Orbital plate extends to about middle of eye; spatulate anterior orbital seta shorter, not extended beyond arista, with the palette lozenge shaped; mesonotum generally darker, with microtomentum gray and general appearance black *capitata* (Wiedemann)
6. Wing with medial band present, free; arista short plumose; orbital setae yellow, slightly thickened, especially anterior one, but more or less pointed *cornuta* Bezzi
Wing with medial band lacking; arista not plumose, with short rays only; orbital setae different, color variable 7
7. Anterior orbital seta about as long as ocellar seta and much longer than posterior orbital seta, black, parallel-sided, twisted 90° at distal $\frac{1}{3}$, more or less truncate at tip; discal band relatively narrow, hardly extended beyond r-m crossvein; cubital band free . . . *pinax* Munro
Anterior orbital seta much shorter than ocellar seta and even shorter than posterior orbital seta, yellow, lanceolate, but usually bifurcate or branched, not twisted; discal band wide, extended much beyond r-m crossvein and connected with cubital band *brachychaeta*, n. sp.
8. All femora and midtibia feathered *tripteris* Munro
Hind femur not feathered, although usually with rows of thin setae; midtibia feathered or not feathered 9
9. Foreleg feathered or bushy (see comment at end of introduction); midleg feathered or not feathered 10
Foreleg neither feathered nor bushy; midleg feathered 17
10. Midleg feathered or bushy 11
Midleg not noticeably feathered or bushy 16
11. Both midfemur and midtibia feathered 12
Either midfemur or midtibia not feathered 14
12. Wing with medial band present (connected with marginal band); frontal setae lacking; forefemur bushy; midfemur feathered ventrally on distal $\frac{1}{2}$; midtibia feathered both dorsally and ventrally on distal $\frac{3}{4}$; all leg setae and feathering golden yellow *fulcoides* Munro
Wing with medial band lacking; frontal setae present; forefemur variable; midfemur and midtibia different 13
13. Midfemur with a complete row of feathering ventrally; midtibia feathered dorsally on distal $\frac{1}{10}$ and ventrally on distal $\frac{2}{3}$ *lepida* Munro

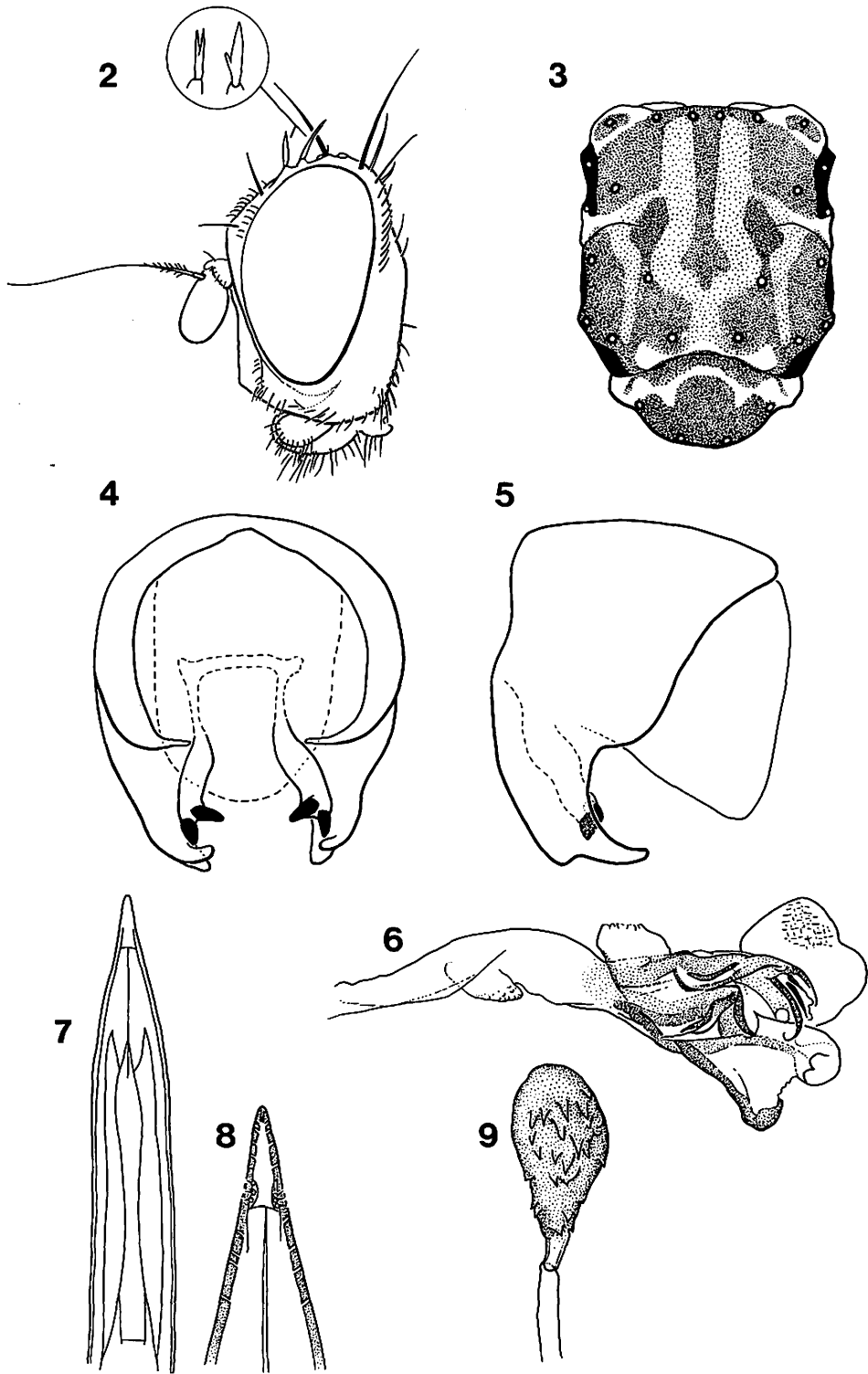
- Ventral feathering on midfemur with short interruption near middle; midtibia feathered dorsally on distal $\frac{5}{8}$ and ventrally on distal $\frac{1}{2}$ *colae* Silvestri
14. Midfemur feathered and bushy; midtibia not feathered; forefemur feathered, mostly with yellow setae; medial band lacking *curvata* Munro
Midfemur neither feathered nor bushy; midtibia feathered; forefemur variable; medial band present 15
15. Forefemur with black setae only; foretibia of normal shape; midtibia of more or less normal shape, feathered both dorsally and ventrally on distal $\frac{3}{5}$; midtarsus normal; 2 orbital setae present *gravinotata* Munro
Forefemur with white setae dorsally, black setae ventrally; foretibia broadened, white; midtibia compressed on proximal $\frac{3}{4}$, feathered dorsally and ventrally on distal $\frac{1}{4}$; midbasitarsus compressed, white; occasionally with 3 orbital setae *tananarivana* Hancock
16. Forefemur with feathering yellow, except for black posterobasal patch; midtibia without black spot anteroapically; wing with strong cleft at apex of vein M and distinct posteroapical lobe *lobata* Munro
Forefemur bushy, with intermixed black and yellow setae; midtibia with small black spot anteroapically; wing without such cleft and lobe *pedestris* Bezzi
17. Both midfemur and midtibia feathered 18
Either midfemur or midtibia not feathered 20
18. Wing with marginal band reduced to several small spots; midfemur with short feathering dorsally on distal $\frac{2}{3}$; midtibia feathered dorsally and ventrally on distal $\frac{1}{2}$ *flexuosa* Walker
Wing with marginal band complete; midfemur and midtibia different 19
19. Wing with medial band lacking; midfemur entirely yellow or basally brown, feathered ventrally on distal $\frac{2}{3}$, with numerous blackish setulae covering most of anterior aspect of basal $\frac{1}{2}$ *anonae* Graham
Wing with medial band as free streak or band; midfemur entirely or apically blackened, feathered ventrally on distal $\frac{1}{2}$, with some blackish setulae restricted to anterior aspect of distal $\frac{1}{2}$ *rubivora* Coquillett
20. Midfemur feathered dorsally on about distal $\frac{1}{4}$, ventrally on distal $\frac{1}{2}$; midtibia not feathered; medial band lacking; marginal and discal bands connected *pinnatifemur* Enderlein
Midfemur not feathered; midtibia feathered; wing pattern variable 21
21. Midtibia feathered dorsally on distal $\frac{9}{10}$, ventrally on distal $\frac{5}{6}$; medial band usually lacking; other bands free *acicularis* Munro
Midtibia feathered dorsally and ventrally on distal $\frac{1}{2}$ - $\frac{2}{3}$; wing pattern variable 22
22. Midtibia anteriorly with distinct 3rd row of feathering; midtarsus mostly blackened; arista with short rays; medial band normally present as free streak *podocarpi* Bezzi
Midtibia without 3rd row of feathering; midtarsus yellow; arista distinctly plumose; wing pattern variable 23
23. Wing with marginal and discal bands connected; medial streak present, free; midtibia blackened anteriorly on distal $\frac{1}{2}$, with numerous short, black setae, feathered dorsally and ventrally on distal $\frac{3}{5}$; frons blackened anteriorly; face blackened on ventral $\frac{1}{2}$ *penicillata* Bigot
Wing with marginal and discal bands free; medial streak lacking; midtibia yellow or blackened distally, feathered dorsally and ventrally on distal $\frac{1}{2}$ - $\frac{2}{3}$, with yellow or brown setulae anteriorly; frons and face completely yellowish *rosa* Karsch

SYSTEMATICS

Ceratitis (Ceratitis) brachychaeta Freidberg, new species

Figs. 2-11

Description. MALE. *Head* (Fig. 2). Generally whitish to yellowish, with ocellar triangle blackish, "V" mark dorsally on occiput brown; mesofrons, antenna, proboscis, and palpus yellow. Microtomentum whitish, slight, distinct only on face and ventral $\frac{1}{2}$ of occiput. Measurements and structure (whenever possible represent averages based on 5 males):



Figs. 2-9. *Ceratitis (Ceratitis) brachychaeta*, n. sp.: 2, head, male, lateral view; inset: orbital setae, anterior view; 3, thorax, dorsal view; 4, epandrium, ventral view; 5, epandrium, lateral view; 6, distiphallus; 7, aculeus, entire; 8, aculeus, apex; 9, spermatheca.

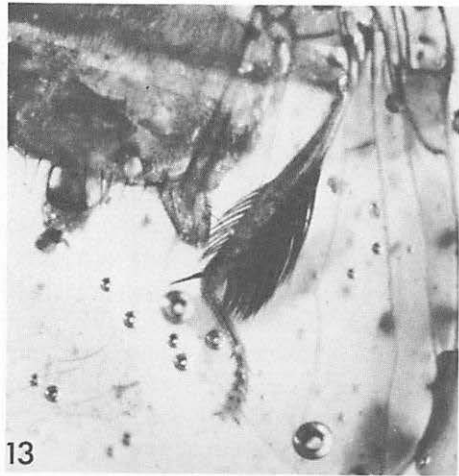
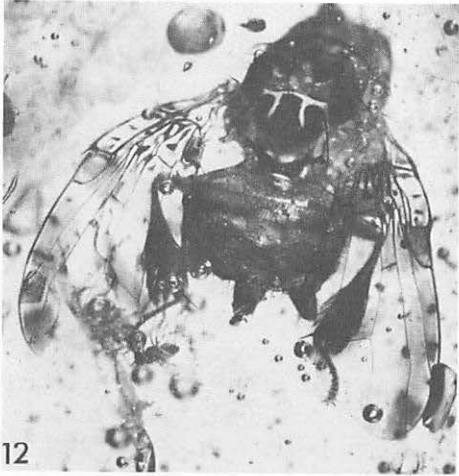
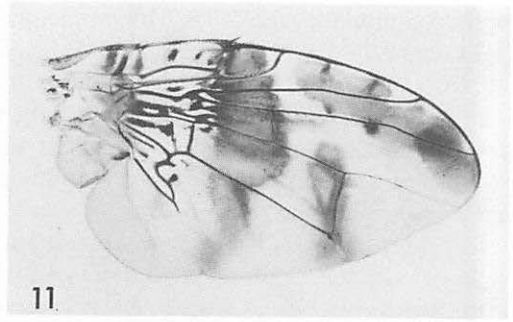
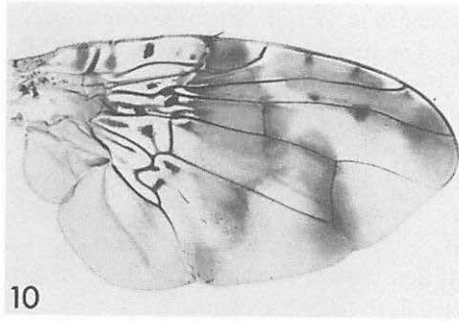
length:height:width ratio 5.3:8.2:10; eye height–eye length ratio 1.56; antennal length–facial height ratio 0.75; 1st flagellomere length to height ratio 1.9; arista length–antennal length ratio 2.16; frontal width (at vertex)–head width ratio 0.34; frontal length–frontal width (at vertex) ratio 1.44; vertical plate length–frontal length ratio 0.5; genal height–eye height ratio 0.15; frontofacial angle varies greatly, from about 100° to about 135°, apparently according to the condition of the specimen, but never strongly protruding; face vertical, transversely convex, with conspicuous antennal grooves, especially dorsally; ventral facial margin not or only slightly protruding; 1st flagellomere rounded apically; arista long and thin, with rays slightly longer than its maximum width; dorsal rays extend to about basal $\frac{1}{3}$, ventral rays restricted to the thickened, basal $\frac{1}{5}$; proboscis capitate; palpus normal, slightly broadened apically.

Chaetotaxy: 2 orbital setae, close together, short lanceolate, yellow; anterior about $\frac{1}{2}$ as long as posterior and, as seen in anterior view, usually bifurcate at tip or branched; both on small tubercles; on strongly convergent orbital plates; 2 frontal setae, normal, much longer and thinner than orbitals, yellow; ocellar seta almost as long as inner vertical, blackish; verticals normal, brown to blackish; postocellars and postvertical yellow; postoculars acuminate, brown; genal brownish yellow; setulae on mesofrons, orbit, antenna, occiput, gena, proboscis and palpus fine, yellow or (especially on gena) brownish yellow.

Thorax (Fig. 3). Color pattern and microtomentum typical for the genus; postpronotal seta inserted in small brown spot; dark spot on the mesal end of transverse suture triangular, narrowly connected to larger, dorsocentral spot; microtomentum in generally narrow, longitudinal stripes; pleura entirely yellow, subshiny, with very light microtomentum, yellow setae and setulae; subscutellum shiny black, mediotergite blackish, on dorsal $\frac{2}{3}$ – $\frac{3}{4}$ with dense, white, microtomentum, which extends to, but fades laterally on, laterotergites. Chaetotaxy normal for the genus: 2 scapulars, yellow; 1 postpronotal, 1 presutural, 2 notopleurals, 1 dorsocentral, slightly posterior to anterior supra-alar, 1 prescutellar acrostichal, 2 scutellars, the basals somewhat longer and thicker, 1 anepisternal, 1 katepisternal, 1 anepimeral; all these setae blackish; setulae yellow or golden yellow. Legs yellow, with yellow setae and setulae except apical midtibial spur blackish; forefemur bushy, with posteroventral row of mostly large setae and with several rows of somewhat smaller setae dorsally and anterodorsally; midfemur anteroventrally and posteroventrally at about distal $\frac{1}{2}$ with comb of short setae; hind femur concave at mid-dorsal area, with 2, somewhat irregular, dorsal rows of rather long and erect setae at apical $\frac{2}{5}$, and a shorter, apical, anteroventral comb of shorter setae. *Wing* (Fig. 10). Length (males and females) 3.6–4.1 mm; length–width ratio 1.8; shape, venation and setation typical for genus; pattern rather typical, but sometimes less golden and more blurred brownish, and bands and spots less well defined; marginal band free or indistinctly connected to discal band; discal band relatively wide, occupying more than $\frac{1}{2}$ of length of discal cell, especially wide around vein M, where it fuses with cubital band; c-shaped mark at apex of cell c usually barely distinct.

Abdomen. Yellow with complete, uniform, transversal, whitish gray band of microtomentum posteriorly on terga 2 and 4; band on tergite 2 occupies less than $\frac{1}{2}$ length of tergite; band on tergite 4 occupies $\frac{1}{2}$ – $\frac{3}{4}$ of length of tergite; setae and setulae mostly brown, some setulae paler, especially on posteriormost tergite; epandrium as in Figs. 4–5; distiphallus as in Fig. 6.

FEMALE. Similar to male except for the following. Arista length–antennal length ratio 1.84; arista rays similar to those of male, but extend both dorsally and ventrally almost to tip of arista; head chaetotaxy more normal, with orbital setae acuminate and blackish, anterior orbital seta as long as posterior orbital seta or slightly longer, both slightly longer and thicker than frontal setae, which are likewise dark; postocellar and postvertical setae yellow or blackish; discal band in wing (Fig. 11) narrower, as usual for genus, and usually not connected to cubital band; syntergosternal measure (number of terga immediately preceding syntergosternite (ovis-



Figs. 10–13. **10**, *Ceratitis (Ceratitis) brachychaeta*, n. sp., wing, male; **11**, same, female; **12**, *Ceratitis (Pterandrus) ?rosa* Karsch, fossil, dorsal view; **13**, same, right hind leg, with feathering.

cape) with combined length equal to length of sytergosternite) 2; aculeus as in Figs. 7–8; spermathecae 2, as in Fig. 9.

Type data. Holotype ♂ (BPBM 14673): “Amani, Tanganyika [Tanzania] III–1936 [III–, 36 handwritten, the rest printed]/small black fr[uit]: [handwritten]/ F.A. Bianchi Collector.” Allotype ♀, paratypes: 7♂, 6♀, same collecting data as holotype. Additional paratype: 1♂, Tanganayika [Tanzania], Amani, 1957, J. G. Halcrow, from guava. The holotype is in fair condition with the right antenna and some setae missing. The holotype and some paratypes are deposited in the Bishop Museum, Honolulu, Hawai‘i. Other paratypes have been distributed to The Natural History Museum, London, Zoological Museum of Tel Aviv University, and the National Museum of Natural History, Washington, D.C.

Etymology. The specific epithet, *brachychaeta*, refers to the unusually short orbital setae of the male.

Comments. As the key shows, *C. (C.) brachychaeta* is closely related to *C. (C.) pinax*, and the males can be distinguished by the characters in the key. Females of *brachychaeta* can be distinguished from those of *pinax* by the following characters:

C. (C.) pinax Munro—Anterior orbital seta about 2× as long as posterior; posteroventral row of setae on forefemur black; in wing, marginal band and discal band connected; discal band clearly reaches hind margin.

C. (C.) brachychaeta, n. sp. — Anterior orbital seta only slightly longer than posterior; posteroventral row of setae on forefemur yellow to brown; wing bands free; discal band does not clearly reach hind margin.

This species is a potential pest of fruit as indicated by the association with guava recorded for 1 of the paratypes. However, "from guava" merely indicates collecting and not necessarily a rearing record. Other species in subgenera *Ceratitidis* (*Ceratitidis*) and *C. (Pterandrus)* are polyphagous pests of fruit.

FIRST RECORD OF TEPHRITID FOSSILS IN AMBER

Through the courtesy of David A. Grimaldi (American Museum of Natural History) I was able to study what appears to be the 1st tephritid fossils discovered in amber. One specimen is a male *Ceratitidis (Pterandrus)* (Figs. 12, 13), which easily runs to *C. (P.) rosa* in the above key. It is in good condition, and the leg and wing characters are clear. The head is up against the edge of the embedding material, but the characters can still be seen, though with some difficulty. Because the embedding material has been neither analyzed nor dated, I am reluctant to positively identify the species of the fossil. The specimen was found in Tanzania, within the current range of the species. It is remarkable that a tephritid species that is a current agricultural pest should also be found as a fossil. Only about 3% of the approximately 4,000 known tephritid species are pests of commercial vegetables or fruit. According to David Grimaldi (pers. comm.) the fossil is possibly older than Pleistocene. The specimen is labeled "AMBER or COPAL, from TANZANIA: specific locality unknown. Yale Peabody Museum of Nat. Hist. no. K."

The other fossil, probably a species of *Trirhithrum*, has a similar label except that it is marked no. 46. Because of the position of this fly in the embedding material, it cannot be studied further at this time.

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