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INDO-MALAYAN AND PAPUAN FIG WASPS (HYMENOPTERA, CHALCIDOIDEA)

4. AGAONIDAE FROM FICUS SECTION ADENOSPERMA

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with 27 text-figures

When I published my review of the host preferences of the Agaonidae (Wiebes, 1963: 92-106, tables 2-3), the pollinator wasps of two sections of the subgenus *Ficus* L. were not yet known. From *Ficus tsiangii* Merrill, the only species of section *Sinosycidium* Corner, I still did not see any fig wasps, but earlier this year Mr. E. J. H. Corner sent two samples of wasps from figs of the other section, *Adenosperma* Corner. Both samples, from *Ficus adenosperma* Miquel and *Ficus verticillaris* Corner, contained species of *Ceratosolen* Mayr related to the wasps from section *Sycocarpus* Miquel subsections *Auriculisperma* Corner, *Theophrastoides* Corner¹⁾ and *Papua-syce* Corner. When more species of the same facies become known, it may be necessary to create a new species group for their reception. For the time being, they are placed in the *Ceratosolen armipes*-group.

A note on the tarsal protuberances in the males as a group character in *Ceratosolen*, follows the descriptions of the species.

***Ceratosolen adenospermae* nov. spec. (fig. 1-16)**

Material. — Series ♂, ♀, Lae, Terr. New Guinea, 17.vi.1964, ex *Ficus adenosperma* Miquel var. *chaetophora* (Warburg) Corner (leg. et det. E. J. H. Corner); coll. RMNH no. 725; holotype ♂, slide no. 725a; allotype ♀, no. 725d; paratypes ♂, ♀, nos. 725b, c, e.

¹⁾ *Ficus salomonensis* Reehinger does not belong to subsection *Vitienses* Corner as indicated in my table 3 (Wiebes, 1963: 102), but to *Theophrastoides* Corner (cf. Corner, 1965: 84).

Description. — Male. Head (fig. 3) longer than wide (2 : 1), and less depress than usual in the genus. The anterior part, both dorsally and ventrally, with sparse, small, spine-like hairs. Eyes small, rather close to the insertions of the mandibles. Epistomal margin tridentate, the lateral lobes more prominent than the mid lobe. Antennal grooves closed. Antenna (fig. 15) four-segmented; the scape (2 : 1) approximately twice as long as the pedicel and a little wider; the penultimate segment as wide as the pedicel, subequal in length in dorsal aspect, much longer (5 : 3) in ventral view; the ultimate segment as long as the penultimate, but here longer in dorsal than in ventral aspect (5 : 3); penultimate and ultimate segments with one and two lateral hairs, respectively. Mandible (fig. 2) tridentate, but with two glands. Maxillae and labium atrophied.

Thorax (fig. 3) glabrous. Pronotum not much longer than mesonotum and metanotum combined, slightly tapering anteriorly; the mesonotum twice as wide as long, with straight anterior and posterior edges; the metanotum approximately half as long, the posterior edge twice incurved. Propodeum almost twice as long as the metanotum; the spiracular peritremata very large, partly lateral in position. Fore leg (fig. 9) robust; the coxa subquadrate; the femur sparsely pubescent, one and a half times as long as the tibia including the dorsal teeth; the tibial armature consisting of four dorsal teeth and one ventral, the disc with a few hairs; the tarsus bimerous, the segments subequal in length, the first segment with small protuberances along the plantar edge. Mid leg (fig. 8) small, but not very slender; the coxa more than half as long as the femur, which is approximately as long as the tibia; the tibia with some spine-like hairs along the dorsal margin, and two longer hairs next to the ventro-apical tooth; the segments of the pentamerous tarsus approximately in ratio 6 : 3 : 3 : 2 : 8, the plantar edges of the first to fourth segments with protuberances. Hind leg (fig. 1) with its coxa nearly as wide as the femur but somewhat shorter; the tibia as long as the coxa, with some small scattered hairs, the ventral armature consisting of four subapical teeth, and one motile, bicuspidate apical tooth; the tarsus with spines and plantar protuberances, especially in the distal part of the segments, the segments approximately in ratio 11 : 3 : 3 : 3 : 5.

Gaster. Genitalia without appendages. Aedeagus (fig. 16) with hyaline dilatations.

Length (head, thorax and propodeum), 1.0 mm. Colour uniform light brown.

Female. — Head approximately as long as wide across the compound eyes. Longitudinal diameter of the eye one and a half times the length of

the cheek. Face with rather long pubescence. Lateral expansions of the epistomal margin rounded, not more prominent than the mid lobe. Antenna (fig. 5-6): the scape twice as long as wide, with a distinct ventral prominence; the pedicel little longer than one-third of the scape, with some long hairs on the paraxial surface, and about twenty stout, peg-like spines on the axial; the appendage of the third segment robust, curved; the fourth segment nearly half as long as the pedicel, almost twice as long as wide, with two subapical, ventral hairs; the fifth segment twice as long as the fourth, with long hairs and three sensilla; the sixth to eleventh segments pubescent, with a long, stouter hair on the ventro-apical edge of each segment except for the ultimate; the seventh segment with five oblong sensilla, the sixth to tenth with six or seven, the tenth moreover with some circular pits, the eleventh with three oblong sensilla; the sixth and eleventh segments subequal in length, two-thirds of the length of the fifth, the other segments slightly longer. Labium and maxillae (fig. 12) without appendages, the distal margins fimbriate. Mandible (fig. 11) with four ventral ridges, its appendage with eight lamellae.

Thorax hirsute on the pronotum; the scutum glabrous, slightly longer than its maximum width (5 : 4); the parapsides with five hairs; the scutellum as long as wide anteriorly, the posterior width slightly larger, with seven short hairs (often abraded) along the posterior half of the lateral margins, the declivity rather long, with three hairs along its posterior margin on each side of the median incurvation; the metanotum with four short hairs on each side, evenly spaced from the middle to the lateral edge. Propodeum wide and rather long, with two pairs of hairs on the disc, and approximately ten hairs next to and behind the spiracular peritremata. Fore wing (2 : 1), 1.1 mm long; the veins rather wide, the submarginal, marginal, stigmal and postmarginal approximately in ratio 2 : 2 : 1 : 2, the submarginal vein with two pustules, the stigmal with three; the membrane heavily pubescent, the marginal fringe long. Hind wing (4 : 1), 0.6 mm long; three hamuli (fig. 7); pubescence and fringe as in the fore wing. Femur of the fore leg nearly twice as long as the coxa, with scattered long hairs on the disc, especially in the dorso-apical angle; the tibia (fig. 13) not half as long as the femur, with hairs on the disc, one very long hair close to the ventro-apical edge, and two large, dorso-apical teeth accompanied by two smaller, hyaline denticles; the tarsus pentamerous, with hairs and ventro-apical spines, the segments approximately in ratio 6 : 4 : 3 : 4 : 5. Mid leg slender; the coxa semiglobular; the femur thrice as long as the trochanter, sparsely hirsute; the tibia subclavate, longer than the femur (9 : 7), with long hairs and one apical spur (fig. 10); the tarsus pentamerous, with hairs and ventral

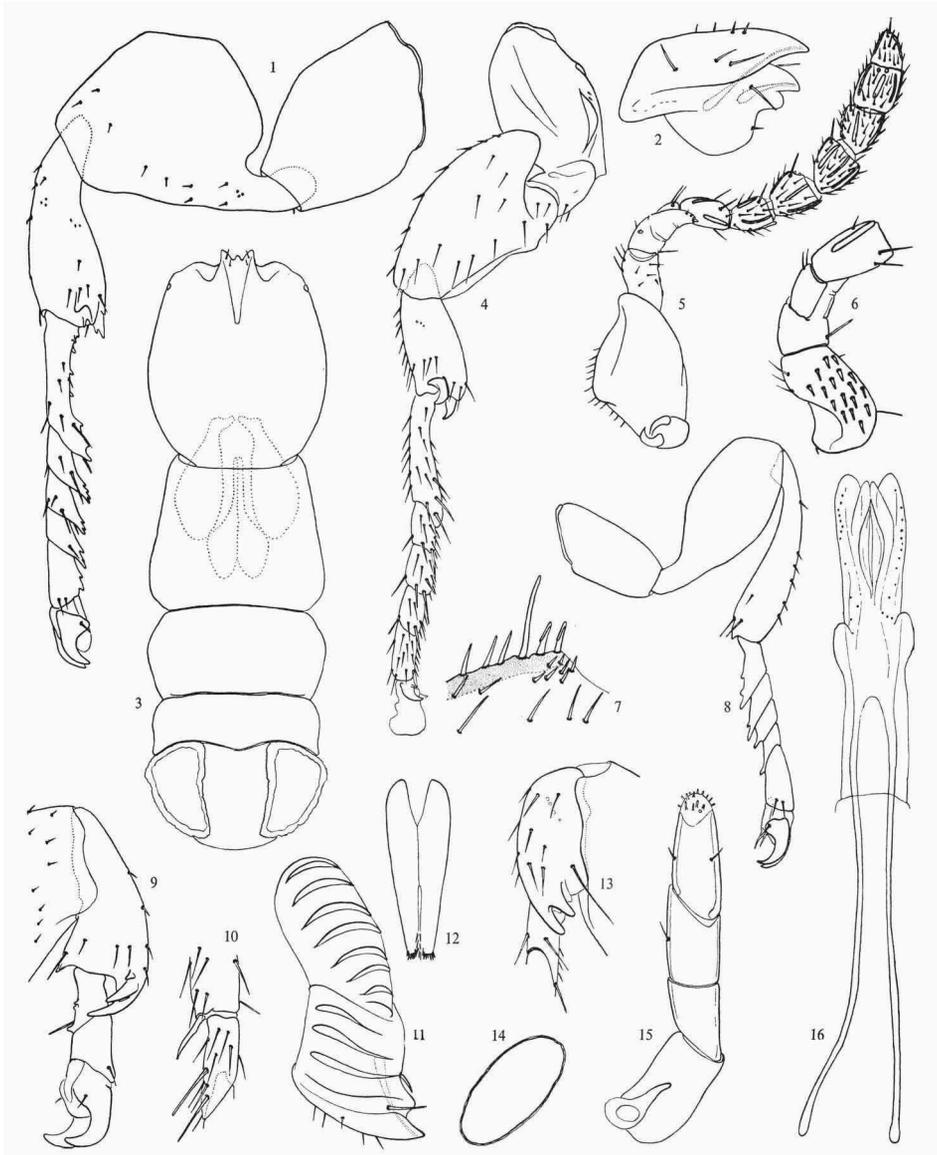


Fig. 1-16, *Ceratosolen adenospermae* nov. spec. 1, ♂ hind leg, paraxial aspect; 2, ♂ mandible, ventral aspect; 3, ♂ head and thorax, dorsal aspect (pubescence omitted); 4, ♀ hind leg, paraxial aspect; 5, ♀ antenna, paraxial aspect; 6, detail of ♀ antenna, axial aspect; 7, hamuli of ♀ hind wing; 8, ♂ mid leg, axial aspect; 9, tibia and tarsus of ♂ fore leg, paraxial aspect; 10, apex of tibia and metatarsus of ♀ mid leg, axial aspect; 11, ♀ mandible, ventral aspect; 12, ♀ labium and maxillae, ventral aspect; 13, tibia and metatarsus of ♀ fore leg, paraxial aspect; 14, outline of spiracular peritreme of ♀ eighth urotergite; 15, ♂ antenna, dorsal aspect; 16, ♂ genitalia, dorsal aspect. Fig. 3, $\times 90$; 1, 4, 5, 8, 9, 14, 15, $\times 140$; 2, 6, 10-13, 16, $\times 230$; 7, $\times 360$.

spines, the segments approximately in ratio 10 : 6 : 8 : 5 : 10. Hind leg (fig. 4): the coxa large, with a paraxial ridge; the trochanter one-third of the length of the coxa; the femur about as long as coxa and trochanter combined, with scattered long hairs, and a ventral groove for the reception of the tibia; the tibia two-thirds of the length of the femur, with dorsal and subapical hairs, and two ventro-apical teeth: the one gently curved, the other widely bidentate; the tarsus pentamerous, with hairs and ventral spines, the segments approximately in ratio 20 : 7 : 8 : 7 : 9.

Gaster. Spiracular peritremata (fig. 14) of the eighth urotergite elliptical in outline. Cerci of the ninth tergite with four long hairs. Ovipositor valves robust, pubescent, half as long as the gaster.

Length, 1.2 mm. Colour dark brown, the ventral surface and the extremities olive-brown. Nervures of the wings brown.

In my key to the Indo-Australian species of *Ceratosolen* (Wiebes, 1963: 88-91), the male of *C. adenospermae* nov. spec. runs to no. 13a, *C. armipes* Wiebes. In comparison with this species, *C. adenospermae* is much smaller, and it is at once recognisable by the protrusions of the tarsi, and by the tridentate mandible. The female, as regards the club-shaped distal segments of the antenna and the apical armature of the fore tibia, shows more resemblance to *C. emarginatus* Mayr and its relatives. In the shape of the hind leg, however, it is closer to *C. armipes*.

***Ceratosolen bimerus* nov. spec. (fig. 17-27)**

Material. — Series ♂, one immature ♀, Ysabel, Solomon Is., vi.1964, ex *Ficus verticillaris* Corner (leg. et det. E. J. H. Corner, BSIP no. 4403); coll. RMNH no. 724; holotype ♂, slide no. 724a; allotype ♀, no. 724c; paratype ♂, no. 724b.

Description. — Head (fig. 24) slightly wider than two-thirds of the length, depress, with very small hairs on the dorsal and on the anterior part of the ventral, surfaces. Eyes close to the insertions of the mandibles. Antennal grooves nearly closed. Antenna (fig. 20) four-segmented; the scape (2 : 1) approximately as long as the pedicel; the penultimate segment much longer (3 : 2); the ultimate segment but little longer than the pedicel; all segments from the pedicel onwards with dorsal hairs as in the figure. Mandible (fig. 18) bidentate. Maxillae and labium atrophied.

Thorax (fig. 24) minutely pubescent on the pronotum, the other terga glabrous. Pronotum nearly as wide as long, the outgrowths of the spiracula distinctly visible as circular membranes in the posterior corners; the mesonotum more than half as long as the pronotum and little wider, the posterior edge gently curved; the metanotum approximately as wide as the

mesonotum, its length in the median region about one-third, in the lateral parts almost equal to the length of the mesonotum, incompletely separate from the propodeum. Propodeum narrower than the metanotum, the median length twice the lateral length of the metanotum; the spiracular peritremata about half as long, fully dorsal in position. Fore leg (fig. 27) rather large; the tibia almost half as long as the subglabrous femur, the armature consisting of three dorsal teeth, one ventral tooth, and a number of long hairs on the paraxial disc; the tarsus bimerous, its plantar edge with protuberances, the segments in ratio 4 : 3. Mid leg (fig. 17): the femur and the tibia subequal in length, not nearly twice as long as the coxa; the tibia arcuate, with scattered long hairs on the paraxial disc, and some stouter, spine-like axial hairs, apically with a blunt tooth in the ventral angle, next to a pair of stiff hairs; the tarsus bimerous, with protuberances along the plantar edge, the segments in ratio 3 : 4. Hind leg (fig. 21) much like the mid leg but more robust; the coxa about as long as the femur; the tibia slightly longer, with short hairs along the dorsal margin, the ventro-apical armature consisting of two paraxial teeth and one axial; the tarsus bimerous, with plantar protuberances, the segments subequal in length.

Gaster. Claspers²⁾ of the genitalia (fig. 26) with two claws, parameres hyaline, rather long. Apodemae aedeagales very long.

Length (head, thorax and propodeum), 1.3 mm. Colour uniform yellowish brown.

Female. The only specimen was dissected out of its gall flower, and consequently cannot be described in the usual detail. Antenna (fig. 25) pubescent; the scape twice as long as wide, with spine-like hairs along the margin of the ventral protrusion; the pedicel one-third of the length of the scape, with approximately sixty spines on the axial surface; the appendage of the third segment large, curved; the fourth segment small; the fifth not much longer; the sixth and seventh longer, the seventh twice as long as the fourth; the eighth to tenth segments subequal, as long as the fifth, transverse; the ultimate segment small; the fifth to eleventh segments bear oblong sensilla (the fifth seven, the sixth and seventh about ten, the eighth to tenth about fifteen, the ultimate two), from the sixth onwards the segments have some circular pits close to the distal margin. Maxilla without process. Mandible (fig. 23) with five ventral ridges, its appendage with eight lamellae.

Thorax. Fore wing (2 : 1): submarginal, marginal, stigmal and post-

2) Prof. Dr. G. Grandi drew my attention to the incorrect use of the term "cerci" for these appendages in my previous papers.

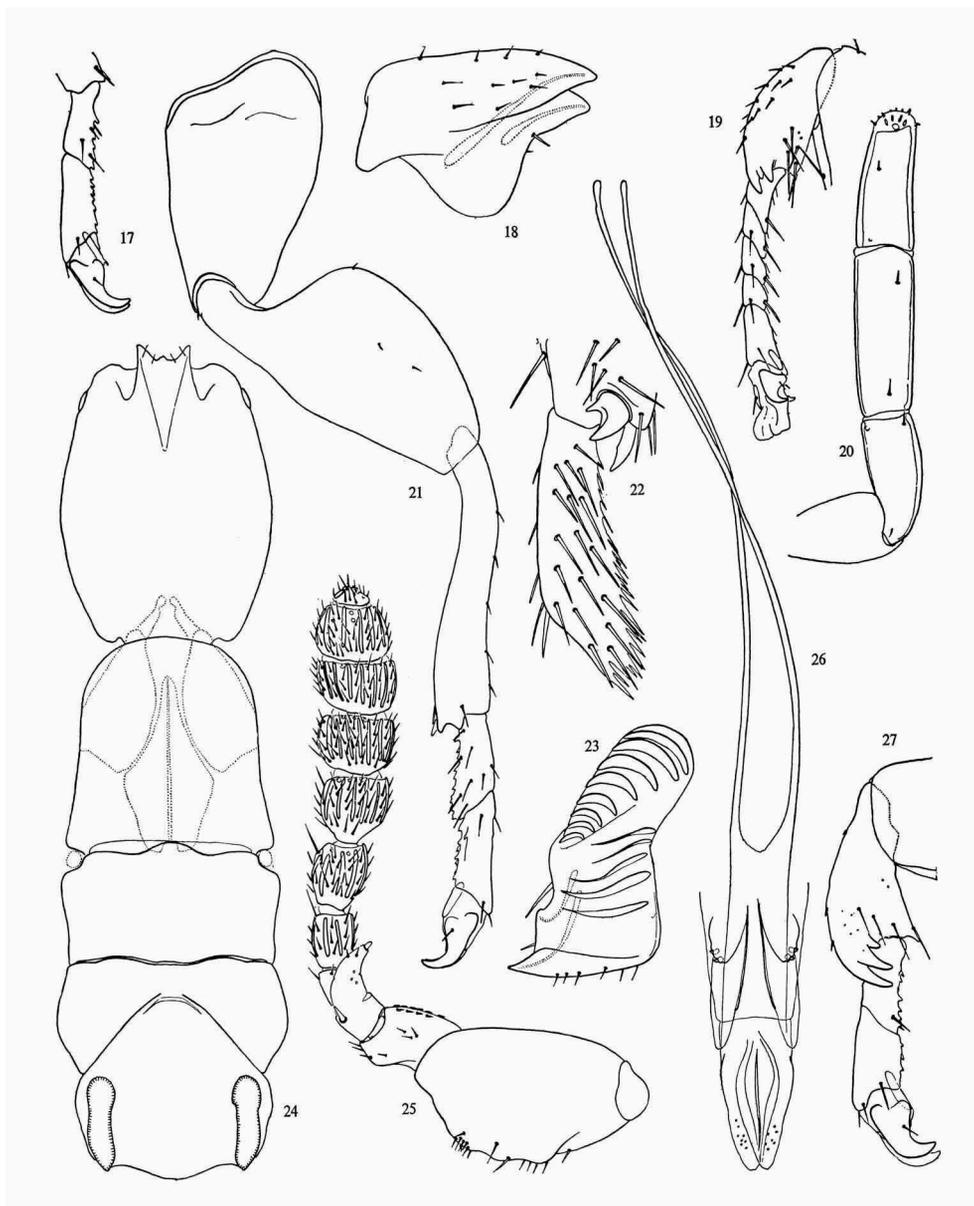


Fig. 17-27, *Ceratosolen bimerus* nov. spec. 17, apex of tibia and tarsus of ♂ mid leg, axial aspect; 18, ♂ mandible, ventral aspect; 19, tibia and tarsus of ♀ fore leg, paraxial aspect; 20, ♂ antenna, dorsal aspect; 21, ♂ hind leg, paraxial aspect; 22, apex of tibia and metatarsus of ♀ hind leg, paraxial aspect; 23, ♀ mandible, ventral aspect; 24, ♂ head and thorax, dorsal aspect (pubescence omitted); 25, ♀ antenna, paraxial aspect; 26, ♂ genitalia, dorsal aspect; 27, tibia and tarsus of ♂ fore leg, paraxial aspect.

Fig. 24, $\times 90$; 17, 19, 21, 23, 25, 27, $\times 140$; 18, 20, 22, 26, $\times 230$.

marginal veins approximately in ratio 5 : 2 : 2 : 3; the stigma ill-defined distally, with three pustules, one of which is widely separated from the others; the submarginal vein with one pustule; the membrane heavily pubescent, the fringe long. Hind wing (4 : 1): three hamuli, the membrane pubescent, the fringe long. Fore leg (fig. 19): the coxa two-thirds of the length of the femur; the femur with a few long hairs on the disc and along the ventral and dorsal margins; the tibia half as long as the femur, with hairs along the dorsal margin and some longer hairs in the ventro-apical angle, the dorso-apical armature consisting of four teeth, the ventral-most of which is small and hyaline; the tarsus pentamerous, with hairs and ventral spines, the segments approximately in ratio 3 : 2 : 2 : 2 : 4. Mid leg slender; the coxa semiglobular; the trochanter one-third of the length of the femur; the femur with a few long hairs, particularly along the dorsal and ventral margins; the tibia subclavate, as long as femur and trochanter combined, long pubescent, the hairs stouter towards the apex, no apical spur; the tarsus with hairs and spines, the five segments approximately in ratio 5 : 4 : 4 : 4 : 5. Hind leg: the coxa almost as long as the femur; the femur with long hairs along the margins and on the dorsal part of the disc; the tibia two-thirds of the length of the femur, with hairs and two ventro-apical teeth (fig. 22); the tarsus with hairs and spines, the plantar edge fimbriated (fig. 22), the segments approximately in ratio 16 : 6 : 6 : 4 : 7.

Gaster. The valves of the ovipositor half as long as the gaster.

This species appears to be close to *C. adenospermae* nov. spec., but it is peculiar in the bimerous tarsi of all male legs. The female has fewer teeth in the dorsal comb of the fore tibia than is usual in the *C. armipes*-group, but it is conform in the shape and the armature of the hind leg.

The occurrence of plantar protuberances on the male tarsi as a group character in *Ceratosolen*

The presence of the peculiar protuberances on the plantar edges of the male tarsi in the new species described in this paper — a character to which I did not pay special attention in my classification of Indo-Australian *Ceratosolen* (Wiebes, 1963: 84-87) — led me to a reappraisal of this feature as a group character in the genus.

The protuberances appear to be present in the species of the *C. pygmaeus*-group, but not in *C. constrictus* (Mayr) or *C. hewitti* Waterston, which in this as in many other features, show resemblances to the *C. crassitarsus*- and *C. bisulcatus*-groups. The species of the *C. appendiculatus*-group may have some very small protuberances on the tarsus of the fore leg, except for

C. gravelyi Grandi, which has distinct protuberances on all tarsi, thus connecting the group with the *C. pygmaeus*-group. I recall that *C. gravelyi* in some other characters too (facies, male tibiae without spines on the discs), resembles *C. pygmaeus* Grandi and its allies.

Protuberances are not found in *C. bakeri* Grandi and *C. abnormis* Wiebes, nor in *C. solmsi* (Mayr). *C. brongersmai* Wiebes, however, has distinct protuberances on the hind tarsi, as have the species of the *C. pilipes*-group to which it seems to be close in other respects. In the *C. armipes*-group, finally, to which the new species appear to be related, protuberances do not occur in *C. boschmai* Wiebes, but they are found on some of the legs in the other species.

In most species, there appear to occur either protuberances, or long hairs or spines, or dilated hirsute tarsi; only on the hind tarsi of the males of the *C. pilipes*-group we find protuberances as well as a dense pubescence.

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- WIEBES, J. T., 1963. Taxonomy and host preferences of Indo-Australian fig wasps of the genus *Ceratosolen* (Agaonidae). — Tijdschr. Ent. **106**: 1-112, fig. 1-329, tables 1-3.