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THE SPECIES OF *MONACON* (HYMENOPTERA: CHALCIDOIDEA: PERILAMPIDAE) FROM INDIA AND ADJACENT COUNTRIES

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ABSTRACT

Monacon species (Hymenoptera: Perilampidae) are reviewed for the Indian subcontinent. A new species is described from Maharashtra, and diagnoses, data on distribution and hosts of known species from the region are given. A key to species of *Monacon* of the Indian subcontinent is also provided.

INTRODUCTON

The South and Southeast Asian species of the perilampid genus *Monacon* Waterston were treated taxonomically in a revision of the world species by Bouèek (1980). Mani (1989) gave a modified version of the key to species of *Monacon* published by Hedqvist (1968). Subba Rao (in Subba Rao and Hayat, 1986) gave a catalogue of *Monacon* species of India and adjacent countries. So far only six species of *Monacon* are known from the Indian subcontinent (Noyes, 2013). After studying the Perilampinae and Chrysolampinae (Narendran, 2003 and Narendran and Sudheer 2003), collection made by the second author (PMS) in the Lonar Crater Wildlife Sanctuary (Maharashtra) in 2003 revealed an undescribed species of the genus *Monacon*. This has given us an opportunity to review all the species of the Indian subcontinent, and update the key to species. Diagnoses are provided here of the known species of the Indian subcontinent mainly based on Bouèek's (1980) revision. The Indian subcontinent includes countries south of the Himalayas, ie Pakistan, India, Nepal, Bhutan, Bangladesh, Sri Lanka and Myanmar. Most species of *Monacon* develop as parasites of ambrosia beetles (Coleoptera: Platypodidae). One record mentions Scolytidae as the host.

The holotype of the new species is deposited in the Department of Zoology, University of Calicut (DZUC) pending transfer to the Western Ghat Regional Centre of Zoological survey of India, Kozhikode (ZSIK).

Abbreviations used : AOL = Distance between anterior ocellus and any one posterior ocellus; CC = Costal cell; L = Length; MV = Marginal vein; OOL = Minimum distance between eye and posterior ocellus; PMV = Postmarginal vein; POL = Distance between posterior ocelli; SMV = Submarginal vein; STV = Stigmal vein; T1 to T6 = Gastral tergites 1 to 6; W = width.

Acronyms used : BMNH = The Natural History Museum ,London, U.K.; DZUC= Department of Zoology, University of Calicut, Kerala,India; USNM = The United States National Museum of Natural History, Washington,D.C. U.S.A.; ZSIK=The Western Ghat Regional Centre, Zoological survey of India, Kozhikode, Kerala, India.

Monacon Waterston

1922: *Monacon* Waterston, 24. Type species: *Monacon productum* Waterston; designated by Baltazar, 1966.

Diagnosis: Female and Male: Body black, with or without metallic green or blue refringence, including coxae, often femora and antennal scapes; rest of legs testaceous or pale yellow. Wings often slightly infumate especially below veins. Head with a strong median horn between antennae;

Key words : New species, review, key, Hymenoptera, Perilampidae, *Monacon*, India

scrobe delimited dorsally by distinct carina; parascrobal area more or less elevated. Antennal formula 11110; clava not differentiated from funicle, apex pointed with one or two apical bristles. Malar sulcus may be distinct or indistinct; pronotum often with angulate shoulders; mesoscutum mostly very convex or hump like; scutellum at apex forming distinct angle about 60° to 90°, projecting over basal part of propodeum; propodeum with alveolae and large pits, with a median carina and costula; prepectus relatively large with its dorsal margin 2 or more times longer than length of tegula. Metasoma with a transverse petiole , visible mostly on ventrolateral part, with a row of longitudinal fovea posterior to anterior carinate margin; T1 with a large basal sub triangular fovea , fovea sometimes constricted by submedian swellings; posterior margin of T1 angularly emarginated greatly; ovipositor sheath flattened from side to side (Waterston,1922; Bouèek,1980).

Hosts: Coleoptera (Platypodidae and Scolytidae)

Distribution : Old World (Africa, Asia, New Guinea and Australia)

Remarks : This genus differs from all other genera of Perilampidae in having the frontal median horn between antennae.

Key to species of *Monacon* of India and Adjacent Countries

(Modified from Bouèek, 1980).

1. Lower face below the horn with a pair of distinct tubercle-like elevations or teeth situated at or on lateral margins of clypeus ..... 2.

= Lower face with tubercles or elevations absent .....5.

2. Tubercles of lower face visible only in certain illumination or light; horn gradually tapering to apex, pointed (Fig.5); clypeus moderately shiny, its lower margin only slightly produced; malar space densely sculptured, dull, femora and tibiae testaceous. India .... ***M. productum*** Waterston (in part)

= Tubercles well distinct, also lateral grooves delimiting clypeus developed at least outside of each tubercle; other characters at least partly different ..... 3.

3. Groove-like lateral margin of clypeus ventrally interrupted at upper side of tubercle; horn in dorsal view distinctly widening to apex (Fig.3); sides of mesosoma before tegulae virtually parallel. Myanmar .... ***M. atkinsoni*** Bouèek

= Grooves delimiting sides of clypeus deep, even above tubercles; horn sometimes scarcely widening at apex; sides of mesosoma slightly converging forwards ..... 4.

4. Scutellum plus axillae combined nearly as broad as medially long; scutellum only as long as broad; narrow part of horn(Fig.1) in dorsal view about 2x as long as wide. India .... ***M. abruptum*** Waterston

= Scutellum plus axillae combined distinctly narrower than its length in middle; scutellum broadly meeting mesoscutum, each axilla strongly sloping laterally; axillulae well delimited even anteriorly; narrow part of horn in dorsal view (Fig.2), about 3x as long as wide. Sri Lanka ..... ***M. angustum*** Bouèek

5. Horn (Fig.4) very slender, tapering and narrowly rounded at apex; clypeus fairly shiny, in upper half with few scattered hairs only; parascrobal lobes well protruding above plane of face, protruding part 0.35x as long as eye length in profile(7:20). Myanmar .... ***M. longispina*** Bouèek

= Horn in dorsal view at least slightly widening at apex which is truncate or emarginate at apex or bidentate; other characters partly different 6

6. Clypeus laterally delimited by short and deep groove which suddenly ends below a slight elevation. India, Philippines .... ***M. productum*** Waterston

= Clypeus completely or almost completely bordered (except anterior margin) by distinct or weak groove, without elevation 7

7. Body (Fig.7) black without metallic refringence; PMV shorter than STV (Fig.10) POL 1.7x OOL; height of eye 1.4x its length in profile. India ..... ***M. buldanicum*** Narendran & Sureshan, sp. nov.

= Body, especially head and mesosoma dark metallic green; PMV longer than STV; Height of eye (Fig.6)1.3x its length. Sri Lanka ..... ***M. senex*** Bouèek

For practical reasons the species are arranged alphabetically below :

1. ***Monacon abruptum***Waterston
(Fig.1)

1922 :*Monacon abruptum* Waterston, 29-30. Holotype Female, Bangladesh. Khulna, Sunderbans, Tambulbunia (BMNH).

1980 :*Monacon abruptum* Waterston: Bouček, Keyed.

Diagnosis (Based on Waterston, 1922 and Bouček, 1980). Female: Length 2.6mm. Body black with metallic blue refringence; scrobes not extended as deep channels downwards, hardly reaching below level of horn; narrow part of horn in dorsal view about 2x as long as broad; clypeal tubercles distinct; grooves delimiting sides of clypeus deep , even above tubercles; pilosity on clypeus sparse, hairs not longer than space between them; supra clypeal part usually as shiny as clypeal surface; sides of mesosoma slightly converging forwards; scutellum plus axillae combined nearly as broad as median length; scutellum only narrowly meeting mesoscutum.

Male: Unknown

Hosts : *Platypus uncinatus* Blandford (Platypodidae) on *Heritiera littoralis* Dryand& Alton (Malvaceae) (Bouèek, 1980).

Distribution : India, Bangladesh [In Bouček's citation (1980) the holotype locality id shown as "Tambulbunia" with India in "?" mark. Tambulbunia is in Bangladesh and hence the type locality is Bangladesh.

Remarks : This species comes near *M.angustum* Bouèek in having: 1) grooves delimiting sides of clypeus deep above tubercles; 2) horn scarcely widening to apex and 3) sides of mesosoma slightly converging forwards. However *M. abruptum* differs from *M.angustum* in having: 1) Scutellum plus axillae combined nearly as broad as its median length (In *M.angustum* scutellum plus axillae combined distinctly narrower than its length in middle); 2) Scutellum broadly narrowly meeting mesoscutum (in *M.angustum* scutellum broadly meeting mesoscutum) and 3) Narrow part of horn in dorsal view about 2x as long as broad (in *M.angustum* narrow part of horn in dorsal view about 3x as long as broad).

2. ***Monacon angustum*** Bouček
(Fig. 2)

1980 :*Monacon angustum* Bouček, 82. Holotype Female, Sri Lanka (USNM)

Diagnosis (Based on Bouček, 1980): Female: Length 2.2mm. Black; tibiae partly and tarsi wholly testaceous; wings hyaline with veins brown and parastigma dark; vertex (outside ocellar triangle), horn and genae almost smooth; horn not distinctly compressed from side to side at base in dorsal view, hardly wide at apex, flattened, truncate, not hollowed (Fig.2); clypeus completely smooth with well delimited on sides and on dorsal side, with a very few scattered hairs; tooth like tubercles present away from the lower margin of clypeus. POL 1.4x OOL; height of malar space 0.31x height of eye , 0.4x eye length; scutellum with apex blunt; in side view scutellum almost flat. PMV barely longer than STV; T1 with basal fovea narrowed and deepened towards distal part.

Male : Unknown

Host : Unknown

Distribution : Sri Lanka

Remarks : This species resembles *M.abruptum* in having characters mentioned under that species above and can be separated by the points mentioned under 'Remarks' under *M.abruptum* above.

3. ***Monacon atkinsoni*** Bouček
(Fig. 3)

1980: *Monacon atkinsoni* Bouček, 84. Holotype Female, Myanmar (=Burma) (BMNH)

Diagnosis : (Based on Bouček, 1980).Female: Length 2.7mm.Black; flagellum, tibiae and tarsus testaceous; wings slightly whitish, venation pale. Head with obliterated reticulation, posterior part of malar space smooth; projecting part of parascrobal space 0.33x length of eye in profile(5:15); horn in dorsal view shorter than 2x as long as apical width, constricted in middle, apex truncate, slightly hollowed beneath; clypeus smooth with a few scattered hairs arising on low papillae; facial

tubercle present; upper margin of clypeus not delimited by groove; POL 1.35x OOL; mesosomal dorsum with smooth and narrow interstices; scutellum 1.5x as long as broad, edges of apex converging at hardly more than 60°. Propodeum with weak irregular median carina. PMV shorter than STV.

Male : Unknown.

Host : Unknown

Distribution : Myanmar

Remarks : This is a unique species with large clypeal tubercles and subcylindrical mesosoma which is relatively longer than in other species.

4. ***Monacon buldanicum*** Narendran & Sureshan, sp. nov.
(Figs. 7-10)

Male (Holotype) : Length : 3.5mm. Black, coxae black with apices pale; fore and mid trochanters brown with apices pale; fore and mid femora dark brown with apices pale yellow; hind trochanter pale yellow; hind femur blackish brown with base and apex pale yellow; all tibiae and tarsi pale yellow. Wings hyaline without any infumation, with veins pale brown; pubescence on body dirty white.

Head : With raised reticulation on frons and gena; weakly reticulate on vertex, not smooth. Width of head in anterior view 1.41x as broad as high (93:66), width in dorsal view 3.2x its length. Relative measurements: POL = 10; OOL = 6; AOL = 3; minimum width between compound eyes at vertex 3x POL; horn distinctly compressed from side to side at base, in dorsal view widening at apex, slightly bifid at apex, hollowed beneath; clypeus laterally delimited by short and deep groove which is weakly curved above basal margin of clypeus to meet opposite groove below a slight elevation; clypeus with raised coarse reticulation, pilose, its lower margin produced forward slightly and semicircular; labrum with 16-19 radiating digital setae at margin; parascrobal lobes in profile distinctly protruding, protruding part in side view 0.39x as long as eye length, 0.28x eye height; scrobe not reaching downwards to level with centre of clypeus; eye height in profile 1.4x its length (25:18); height of malar space about half length of eye height (12:25); malar groove weak , partially visible on lower half. Antenna with, scape, pedicel, one anellus plus 10 segmented funicle plus clava (clava not differentiated from funicle); scape slightly exceeding level of vertex; relative L:W of antennal segments: scape = 18:2; pedicel =5:4; anellus = 3:1; F1 = 4:4; F2 = 4:6; F3 = 3:6; F4 = 3:6; F5 = 3:6; F6 = 3:5; F7= 3.5; F8 = 2.5:5; F9 = 2.5:4; F9 = 2.5:4; F10 = 4:3.

Mesosoma : Strongly convex; with deep umbilicate setigerous pits; interstices carinate, 1.46x as long as wide; mesoscutum broader than sharp shouldered pronotum (24:22); scutellum plus axillae combined, 1.22x as broad as long; apical edges of scutellum converging a little over 60°. Propodeum alveolate with strong raised median arch like carina, crossed just behind middle by strong costula; convex sides, closely and irregularly punctate with deep alveolate pits; spiracle 2x longer than wide, separated from posterior margin of metanotum by a distance longer than length of spiracle (5:4). Forewing 2x as long as wide; narrow, PMV slightly shorter than STV (8:10), latter slightly knobbed; relative length of CC = 65; SMV =62; MV = 23; PMV = 8; STV =10; parastigma = 10. Hind coxa bare on dorsal side except for a bunch of white setae on dorsal margin in posterior half (Fig.11); ventral side fully pubescent.

Gaster : Shorter than mesosoma (64:84); T1 with a subtriangular basal median fovea, exceeding half way to apical margin of T1; maximum length of T1 in dorsal view 1.43x maximum length of visible part of T2; T3 longest, 2x as long as T1; T4 0.25x as long as T3; T5 shorter than T4; T6 shorter than T5; T1 and T2 bare; T3 with a few weak pubescence on posterior admarginal area; T4 with about 32-36 weak setae; T6 18-20 setae.

Variation : Length 3 - 3.5 mm.

Female : Unknown

Hosts: Unknown

Distribution: India (Maharashtra).

Material examined : Holotype Male: INDIA, Maharashtra, Buldana district; Lonar Crater Wild Life Sanctuary, West of Kamalaja Devi temple , 20.xi.2003. P.M.Sureshan. Paratype: Same data of Holotype. [Both types are deposited in DZUC pending transfer to ZSIK].

Etymology : Named after the district Buldana of Maharashtra from where the types are collected.

Remarks : This new species comes near *Monacon senex* Bouček in the key to species of *Monacon* by Bouček (1980) but differs from it in having: 1) Body black without metallic refringence (in *M.senex* body, especially head and mesosoma dark metallic green); 2) head in anterior view 1.41x its height (in *M.senex* head in anterior view 1.3x as long as its height); 3) POL 1.7x OOL (in *M.senex* POL 1.4x OOL); 4)height of malar space 0.5x height of eye in profile (in *M.senex* height of malar space 0.4x height of eye in profile); 5) height of eye 1.4x its length in profile (in *M.senex* height of eye 1.3x its length in profile); and 6) PMV shorter than STV (in *M.senex* PMV longer than STV).

This new species differs from *M.productum* Waterston (which is found in India) in having: 1) body black without metallic refringence (in *M.productum* body black with metallic blue refringence on head and mesosoma); 2) Head with raised reticulation on frons and gena, weakly reticulate on vertex (in *M. productum* head dull shiny except striate on occiput); 3) MV 2.3x as long as STV (in *M.productum* MV 3x as long as STV); 4) height of malar space 0.5x height of eye (in *M.productum* height of malar space 0.3x height of eye in profile) and 5) hind coxa with a bunch of setae on apical half of dorsal margin (in *M.productum* not such distinct bunch of setae on hind coxa).

5. ***Monacon longispina*** Bouček
(Fig. 4)

1980: *Monacon longispina* Bouček, 87. Myanmar, Holotype Female (BMNH)

Diagnosis : (Based on Bouček, 1980): Female: Length 3.6mm. Black; tarsi and part of tibiae dark testaceous; forewing with broad but weak infumation below veins. Projecting part of parascrobal space in side view o.4x length of eye; horn very slender, tapering and narrowly rounded at apex which is truncate or bidentate; clypeal tubercles indistinct. POL 1.1x OOL; height of malar space 0.27x height of eye, 0.35x length of eye in profile; mesosoma strongly convex, interstices narrow and reticulate on mesoscutum; apex of scutellum blunt; propodeum alveolate with sharp median carina and cross carina; PMV barely as long as STV. T1 with anterior median fovea hardly reaching half length of T1 medially.

Male : Unknown

Host : Unknown

Distribution : Myanmar

Remarks: This species comes near *M.productum* and *M.senex* in having head without clypeal tubercles. However *M.longispina* differs from them in having: 1) horn slender, tapering and narrowly rounded at apex (in *M.productum* and *M.senex* horn slightly widening at apex in dorsal view). Besides, *M.productum* differs from *M.longispina* in having projected part of parascrobal space 0.32x length of eye in profile (in *M.longispina* projected part of parascrobal space 0.4x length of eye) and in M.senex POL 1.4x OOL (in *M.longispina* POL 1.1x OOL).

6. ***Monacon productum*** Waterston
(Fig. 5)

1922: *Monacon productum* Waterston, 25-28. Holotype Female, India, West Bengal (BMNH)

Diagnosis (Based on Waterston, 1922 and Bouček, 1980) : Female: Length 3.2mm.Black with metallic blue refringence on head and mesosoma; antennae blackish brown; coxae black; femora blackish brown; head dull shiny with striate occiput and irregularly striate vertex; projected part of parascrobal space in side view 0.32x eye length; height of malar space 0.2x eye height in side view; clypeus laterally delimited by short and deep groove, not connected with each other on upper margin; clypeal tubercles indistinct; horn gradually tapering to apex, pointed; clypeus moderately shiny; mesoscutum and scutellum with umbilicate punctures, interstices narrower than half diameter of a puncture (except in some areas on sides of scutellum where interstices wider than diameter of a puncture and smooth). MV 3x PMV; STV as long as PMV.

Male : Length 3mm. Similar to female with slight difference in sculpture of propodeum.

Host : *Diacavus furtivus* (Sampson)(Coleoptera: Platypodidae) attacking *Shorea robusta* Gaerten (Dipterocarpaceae)

Distribution : India (West Bengal); Borneo, East Malaysia.

Remarks : This species comes near *M.buldanicum* sp.nov. in having clypeal tubercles indistinct and mesosoma closely and umbilicately punctate. However *M. productum* differs from *M. buldanicum* in having: 1) body black with metallic blue refringence on head and mesosoma (in *M.buldanicum* body black without metallic refringence); 2) Surface of head dull shiny with occiput only striate (in *M.buldanicum* surface of head with raised reticulation on frons and gena, weakly reticulate on vertex, occiput striate-reticulate); 3) MV 3x as long as STV (in *M.buldanicum* MV 2.3x as long as STV); Height of malar space 0.3x height of eye in profile (in *M.buldanicum* height of malar space 0.5x height of eye in profile) and 5) Hind coxa without any distinct bunch of setae on dorsal margin of hind coxa (in *M.buldanicum* hind coxa with a bunch of white seae on posterior half of dorsal margin).

7. ***Monacon senex*** Bouček
(Fig. 6)

1980 : *Monacon senex* Bouček, 91. Holotype Female, Sri Lanka (BMNH).

Diagnosis : (Based on Bouček, 1980). Male: Length 2.6 – 2.8mm. Body, particularly head and mesosoma dark metallic green; tibiae scarcely infuscate, otherwise together with tarsi testaceous; wings subhyaline; veins pale except for darker parastigma. Projecting part of parascrobal space 0.4x as long as eye length in profile; height of malar space 0.4x height of eye, 0.47x length of eye in profile; horn in dorsal view parallel sided, compressed at base, its apex truncate – sub emarginate, slightly hollowed ventrally; vertex slightly shiny, otherwise head distinctly sculptured; clypeus fairly delimited by grooves; scape distinctly exceeding anterior ocellus. Dorsum of mesosoma densely punctured; scutellum (less axillae) 1.23x its width, its apical edges subsinuate. Propodeum with strong median arched carina with strong costula.PMV slightly longer than STV, latter distinctly knobbed.

Female : Unknown

Hosts : Unknown

Distribution : Sri Lanka

Remarks : *M.senex* comes near *M.buldanicum* in having clypeal surface dull, very densely sculptured and pilose; parascrobal lobes in profile distinctly protruding and interstices on mesoscutum very narrow. However *M.senex* differs from *M.buldanicum* in having: 1) head and mesosoma dark metallic green (in *M.buldanicum* body black without any metallic refringence); 2) head in anterior view 1.3x as long as its height (in *M.buldanicum* head in anterior view 1.41x its height);3) POL 1.4x OOL (in *M.buldanicum* POL 1.7x OOL); 4) height of malar space 0.4x height of eye in profile (in *M.buldanicum* height of malar space 0.5x height of eye); 5) height of eye 1.3x its length (in *M.buldanicum* height of eye 1.4x its length); and 6) PMV longer than STV (in *M.buldanicum* PMV shorter than STV).

CHECK LIST OF *MONACON* WATERSTON SPECIES OF THE WORLD

M.abruptum Waterston, 1922.....India, Bangladesh

M.atkinsoni Bouček,1982 ..... Sri Lanka

M.aurantiops Bouček, 1982 ..... Uganda

M.beaveri Bouček,1982 ..... West Malaysia

M.bifidum Delucchi,1956 ..... Zaire

M brevicorne Delucchi,1956 ..... Zaire

M.canaliculatum Bouček,1982 ..... Philippines

M.cavifrons Bouček, 1982 ..... Philippines

M.ferrieri Bouček ,1982 ..... Philipines

M.latispina Bouček 1982 ..... Uganda,Nigeria

M.longispina Bouček 1982 ..... West Malaysia

M.malaicum Bouček 1982 .....West Malaysia

M.modestum Bouček 1982 ..... Papua New Guinea

M.naso Bouček 1982 ..... Papua New Guinea

M.nigrum Delucchi 1956 ..... Zaire

M.onkops Bouček 1982 ..... Kenya

M.platypodis Bouček 1982 .....Papua New Guinea

M.productum Waterston 1922 ... India,East Malayasia

M.robertsi Bouček 1982 ..... Papua New Guinea

M.senex Bouček 1982 ..... Sri Lanka

M.simplex Bouček 1982 ..... Papua New Guinea

M.spinifrons (Cameron) (Philomedes),1909 .... North Borbeo,Kuchin,Sandakan

M.tricorni Bouček 1982 .... Papua New Guinea, Philippines

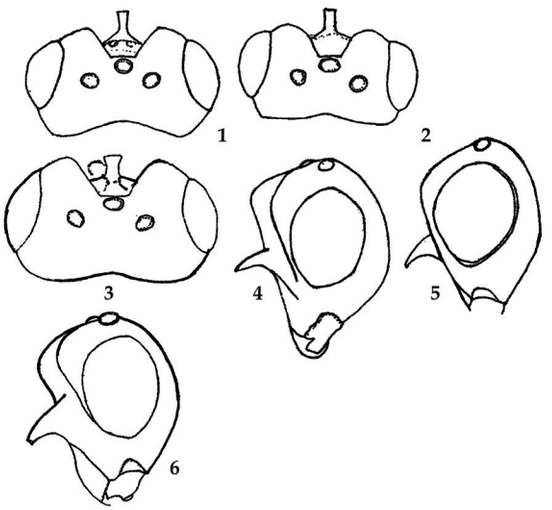

Fig.1-6 : Fig.1 : Monacon abruptum Waterston Female(modified from Bouček1980,(Courtesy Bouček) Head dorsal view; Fig.2 : M.angustum Bouček, Female.Head dorsal view; Fig.3.M.atkinsoni Bouček, Female, head in dorsal view; Fig.4 : Monaconlongispina Bouček, head profile; Fig.5.M.productum, head profile; Fig.6.M.senex Bouček, Male,head profile.

Fig. 7

Fig. 8

Figs. 7 to 8 : Monacon buldanicum Narendran and Sureshan sp.nov. Male: 7.body profile, 8.body dorsal view

Fig. 9. Head anterior view

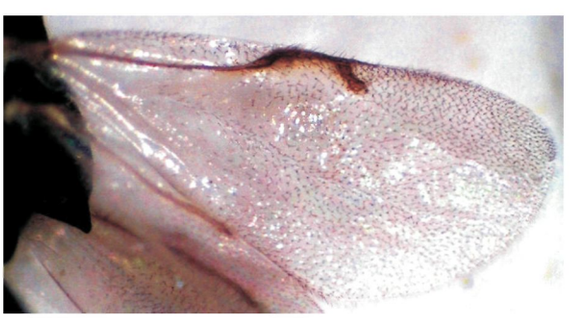

Fig.10. Forewing veins

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