

Grissell 1999

**CONTRIBUTIONS
OF THE
AMERICAN ENTOMOLOGICAL INSTITUTE**

Volume 31, Number 4

**AN ANNOTATED CATALOG OF
WORLD MEGASTIGMINAE (HYMENOPTERA:
CHALCIDOIDEA: TORYMIDAE)**

by

E.E. Grissell

Systematic Entomology Laboratory, PSI, ARS, USDA
c/o National Museum of Natural History
Washington, DC 20560-0168

The American Entomological Institute
3005 SW 56th Avenue
Gainesville, FL 32608-5047

1999

INTRODUCTION

Two subfamilies of Torymidae are currently recognized: Megastigminae and Toryminae (Grissell 1995). The latter subfamily was recently cataloged at the world level (except *Torymus* Dalman given as a checklist, Grissell 1995, updated in part by Graham and Gijswijt 1998), but the Megastigminae have not been cataloged in 50 years (Milliron 1949). At that time 116 species were recognized. In the present paper I present an annotated catalog to the 168 species and 11 genera of Megastigminae recognized at the world level.

Within Megastigminae, the hosts for about one-third the species (63) are unknown, another third (59) are phytophagous as seed feeders and rarely, perhaps, as gall formers, and the remaining third (46) attack insects (Table 1). In the case of entomophagous species not all insect hosts are known, but at least 41 of the 46 megastigmine species are associated with gall-forming hosts (Table 1, p. 85 and Entomophagous Species Host List, p. 61). These findings are at odds with my earlier published comment (Grissell 1995) that 90% of species are phytophagous, a statement based upon then accepted opinions and an incomplete knowledge of the group. Such statements are an example of why catalogs such as this one are needed.

The biology, as opposed to the host records, of species of Megastigminae is still largely unknown in spite of the extensive literature pertaining to economic species in the genus *Megastigmus*, to which most members (80%) of the subfamily belong. Where biology is known, most megastigmine fall into the category of obligate seed-feeder or inhabitants of galls. In the latter case, it is not always clear whether the relationship to galls is as a parasitoid, an inquiline, or a gall-former. Although species of *Bortesia* are reported to be gall-formers (Riek 1966), this has never been positively demonstrated. At least one undescribed species of *Megastigmus* is a gall-former in the seed capsules of *Eucalyptus* (unpublished personal observation based on dissections), and it is likely that the habit is more common than is currently realized. Without study one cannot deduce much information based on rearing a megastigmine from a gall—the options are too great. In the few cases where intensive study has been undertaken, the results have been surprising. Within the genus *Megastigmus*, the only genus where detailed research has been done, three basic feeding types have been documented: 1) Strict phytophagy, in which the larva feeds within a single seed embryo; 2) Partial phytophagy, in which the larva feeds for a time on plant tissue and then consumes the gall-forming host; and 3) Egg-larval parasitism (koinobiont), in which the megastigmine egg is laid in the egg of a gall-forming host but does not hatch until the host larva has achieved a certain size, at which point the megastigmine egg hatches and its larva begins feeding. To this may be added a fourth type, that of gall-former, but this habit is based on data still being analyzed (Grissell and van Noort, in preparation). The role of megastigmynes as possible inquilines is still open to question. Although the biologies of the non-seed feeding species of *Megastigmus* are poorly documented, it is obvious (from point 2, above) that the habit of phytophagy may be found even in some of the "parasitic" forms. The group, then, offers a unique perspective on the study of evolutionary pathways between phytophagy and parasitism. Within the catalog I have cited and summarized specific literature pertaining to biological information.

Many seed-feeding species are known to be economic pests especially in the destruction of commercially produced conifer seeds used in reforestation. In many cases, these species have been moved accidentally throughout the Northern Hemisphere and are of concern to importers and exporters of seed stock in North America, Europe, the former Soviet Union, and China. Some Megastigminae attack the seeds of commercial nuts (e.g., pistachio), fruits (e.g., crab-apple), spices (e.g., pink peppercorns), and cultivated ornamentals (e.g., roses, hollies). One or two species may be considered beneficial because they parasitize the larvae of gall-forming wasps that

attack citrus trees. Our relatively limited knowledge of the biology of Megastigminae, combined with the capacity for phytophagy, entomophagy, and polyphagy within the group, presents a potential Pandora's box of possibilities when it comes to the economic repercussions from this subfamily of wasps. It is necessary, therefore, that observations of biology are carefully made to insure their accuracy and use in predicting potential problems.

Species of Megastigminae are found in all zoogeographic regions (Table 2), though the Neotropical region is virtually devoid of the subfamily. Based on endemic species alone, roughly 90% of species occur in the Old World, with the remaining 10% in the New World. There is a small amount of regional overlap (Table 2; 10 of 168 species) that appears to relate more to human introduction than to natural distribution (i.e., the species are associated with plants moved by humans). The subfamily is relatively most abundant in the Australian region, which contains 50% of all known taxa. The Palearctic Region contains an additional 30% of the world's species. Relatively few taxa occur in the Oriental and Afrotropical regions. In the New World essentially all species are confined to the Nearctic. Five species have been reported as Neotropical, but one of these, *Megastigmus mendocinus* Kieffer and Jorgensen, described from Argentina, was recently found to be a junior synonym of *Torymoides sulcios* (Walker) in the subfamily Toryminae (Grissell and Heydon 1999). To date, no species of Megastigminae are known from South America. The species *Megastigmus albifrons* Walker, ranging from California southward to Guatemala is the only species reliably reported from the Neotropical Region (though not exclusive to it). *Megastigmus spermotrophus* Wachtl, known from northern Mexico, is at best considered an extension from the Nearctic fauna. *Megastigmus orientalis* (Mathur and Hussey) was introduced into Cuba from the Old World. *Megastigmus variegatus* Strand is known only from "Mexico", but its exact distribution is unknown. My colleague Paul Hanson (Universidad de Costa Rica, San José) has several undescribed species of Megastigminae collected in Costa Rica, and these represent the southernmost confirmed range for the subfamily in the New World.

OVERVIEW OF LITERATURE

Much literature is available for the subfamily Megastigminae and especially for the genus *Megastigmus* because it is both speciose and of great economic importance. Below I summarize the most important references that provide information of a general nature and are thus not necessarily referred to within the species sections of the catalog. I have not included a survey of the economic literature, much of which is both specialized and of limited interest relative to the general systematic information normally provided in a catalog.

Catalogs:

The few catalogs for the entire subfamily were produced by Dalla Torre (1898), Schmiedeknecht (1909), and Milliron (1949). A few regional catalogs to the subfamily have been published, but all are superceded by the current listing except that of Peck (1963), which contains many secondary references relevant to megastigmine bionomics. Catalogs published by zoogeographical region are: Australian: Bouček 1988; Nearctic: Peck 1963 (updated by Grissell 1979), Poole and Gentili 1996 (checklist); Neotropical: De Santis 1989 (a single species). Oriental: Mani 1938 (India), Farooqi 1986 (India), Mani 1989 (India), Narendran 1994 (India and adjacent countries), Baltazar 1966 (Philippines). Catalogs for specific genera are mentioned under each generic section in the catalog.

Host Records:

The only attempts to summarize host records for the subfamily at a world level were by Dalla Torre (1898) and Milliron (1949). Two recent publications (Lessmann 1962; Roques and Skrzypczynska in prep.) treat phytophagous species of the genus *Megastigmus*. This latter reference is exceptionally complete and is an excellent source for secondary references to the subject.

Keys:

Existing keys to species are listed under the applicable genera in the catalog. The more comprehensive keys to higher taxa are as follows: Oriental Region: Farooqi 1985 (genera of India), Narendran 1994 (genera and species of Indian subcontinent); Palearctic Region: Nikol'skaya and Zerova 1978 (genera and species, European part of former Soviet Union), Kamijo 1962 (species, Japan), Bouček 1970b (species, Europe); Australasia: Bouček 1988 (genera).

Phylogeny:

Little work has been done on the phylogeny of Megastigminae. Breland (1938) concluded that the subfamily was primitive, but he found evidence to support relationships between Megastigminae and half a dozen other torymid genera, which essentially spanned the phylogeny of the family as we understand it today. Grissell (1995), on the basis of an extensive cladistic analysis, suggested that the subfamily was the primitive sister taxon to Toryminae, the other subfamily in Torymidae.

METHODS

The catalog format is fairly straightforward, but a few comments for its use should be made.

Abbreviations: The following abbreviations are used for museums cited in the catalog.

ANIC = Australian National Insect Collection, CSIRO, Canberra, Australia

BMNH = The Natural History Museum, London, England

BPBM = Bernice P. Bishop Museum, Honolulu, USA

CNC = Canadian National Collection, Ottawa, Canada

CU = Cornell University, Ithaca, NY, United States

ENA = Escuela Nacntional de Agricultura, Capingo, Mexico

FRI = Forest Research Institute, Dehra Dun, India

HU = Hokkaido University, Sapporo, Japan

IARI = Indian Agricultural Research Institute, New Delhi, India

IEUN = Institute de Entomologia, Agraria, Universitá degli di Napoli, Portici, Italy

IFHB = Institut für Forstentomoloige der Hochschule für Bodenkultur, Vienna, Austria

INRA = Institut National de la Recherche Agronomique, Olivet, France

IZU = Institute of Zoology, Ukrainian Academy of Science, Kiev, Ukraine

KU = Kyushu University, Fukuoka, Japan

MNHN = Muséum National d'Histoire Naturelle, Paris, France

MZL = Museum of Zoology, Lund, Sweden

MZUH = Museum Zoologicum Universitatis, Helsenki

NFU = Northeast Forestry University, Harbin, People's Republic of China

NMP = National Museum, Prague, Czechoslovakia

NMV = National Museum of Victoria, Melbourne, Australia

NMW = Naturhistorisches Museum, Vienna, Austria

OUM = Oxford University Museum, Oxford, England
QM = Queensland Museum, Brisbane, Australia
SAM = South Australian Museum, Adelaide, Australia
UM = University of Minnesota, St. Paul, MN, United States
USNM = National Museum of Natural History, Washington, D.C., USA
WADA = Western Australian Department of Agriculture, Perth, Australia
WAM = Western Australian Museum, Perth, Australia
ZAU = Zhejiang Agricultural University, Hangzhou, People's Republic of China
ZI = Zoological Institute, St. Petersburg, Russia
ZMUC = Zoologisk Museum, University of Copenhagen, Copenhagen, Denmark
ZMH = Zoologische Museum, Humboldt Universität, Berlin, Germany

In the case of type localities I use the abbreviations USA (United States of America) and PRC (People's Republic of China). Because the country is spelled out in the distribution section, immediately above the type locality, it did not seem necessary to repeat the entire country name.

Arrangement: All taxa are arranged alphabetically, first by genus then by species. In this manner, all taxa can be located efficiently regardless of the higher classification.

Distribution: Distribution follows the species name and is listed by zoogeographic region. After the region, general distribution may be broadly summarized for common species, especially where this has been done recently in the literature. Most species, however, are known from few localities (often only the type locality), and for these I give the known distribution by country. In a few of the larger countries (e.g., Australia, Canada, India, People's Republic of China, United States), I cite the states or provinces in parentheses. Authorities for distribution are cited in this section, but if none is cited the locality is associated with the type specimens of both valid and synonymous species in the original description, the citation for which will be found in the list of synonyms found directly after the distribution.

Nomenclature: The original description and generic combination is cited below the species name, followed by synonyms, if any. Where I have been able to trace synonymies, I cite the authority for them. Although an attempt has been made to rediscover the authorities for many of the synonyms that existed before the turn of the century, I have not been successful in all cases. Generic transfers are not given under synonymy, but are traced in the taxonomic discussion. I have not verified that every single species is assigned to its correct genus.

Type Material and Localities: For each species name (valid or synonymous) I summarize type localities and state type depository from the original description (see above for abbreviations used). If more recent information has been published for the type, I cite that depository and authority. If I have seen the type, I state "examined" after the depository. If no type information or depository is stated in the original paper, I generally suggest the most likely depository based on my knowledge of the previous history of the author or the work of others (cited) who have deduced this.

Host Records: In this section I cite the host name for each species as it appeared in the original source and in its currently valid form. All authors names are included in the host lists at the end of this paper (pages 54-65). In the plant host list (page 54) names are listed alphabetically by family, then genus and species. In the insect host list (page 61) names are listed alphabetically by order,

then family, genus, and species. The host index (page 66) is an alphabetical summary of all host names at the level of order, family, and genera. Methodologies and sources used for checking nomenclature of hosts is given in the introductions to the plant and insect host lists.

Biology: References to the biological habits of species are cited and summarized.

Economic Importance: I have attempted to highlight major species of economic importance, but I have made no attempt to include all papers dealing with the economics of the genus *Megastigmus*. Within that genus, hundreds of papers have been published that refer to various aspects of the bionomics. The collection of these papers would be an important major project itself. A major contribution to this effort in the Nearctic Region was published by Peck (1963).

Literature Cited: Literature is cited by author and date as is customary. Papers written by Girault, however, are cited by date and publication number (e.g., Girault 1915/234) according to the system devised by Dahms (1978).

Within species sections, citations to references covering the above topics are mentioned only if something is known. I have attempted to be as complete as possible in reviewing all literature pertaining to world species, but in the case of a very few, common species I have selected only the major papers to cite. In the case of some common New World species, I summarize the information given in the catalogs of Peck (1963) and Grissell (1979). Peck's catalog is relatively complete, but often an early paper simply mentioned a locality or a host and then was cited many additional times by subsequent authors without new information. Thus, many (if not most) papers add nothing to the knowledge of a taxon. Where a paper is fairly detailed and comprehensive I cite it for the species being treated.

CATALOG of WORLD MEGASTIGMINAE

Bootanelleus Girault

Bootanelleus Girault 1915/243:308. Type species: *Bootanelleus viridiscutellum* Girault (original designation).

NUMBER OF SPECIES.—13.

DISTRIBUTION.—All species are Australian, but *B. orientalis* has been introduced into other regions.

HOSTS.—The hosts for most species are unknown. Several species have been reared from unidentified galls, and one species is known as a parasitoid of a gall-forming eurytomid. One species is phytophagous in seeds of *Casuarina*.

KEYS TO SPECIES.—No keys have been published.

aereus (Girault). AUSTRALIAN: Australia (Queensland).

Megastigmus (Bootanomyia) aerea Girault 1915/243:305. 2 female syntypes, Brisbane, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1983) discussed the syntypes of this species, indicating that one specimen was a holotype, but this is not evident from the original description. Bouček (1988) transferred the species.

HOST.—Reared from unidentified galls.

ashmeadi (Girault). AUSTRALIAN: Australia (Queensland).

Megastigmus (Bootanomyia) ashmeadi Girault 1915/243:305. Holotype female, Gordonvale (Cairns), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1983) discussed the type of this species, and Bouček (1988) transferred it.

auritibiae (Girault). AUSTRALIAN: Australia (Queensland).

Neomegastigmus auritibiae Girault 1915/243:297. Holotype female, Capeville (Pentland), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1983) discussed the type of this species, and Bouček (1988) transferred it.

hyalinus (Girault). AUSTRALIAN: Australia (New South Wales).

Neomegastigmus hyalinus Girault 1915/243:296. Holotype female, Chinderah, New South Wales, Australia (QM, examined).

TAXONOMY.—Dahms (1984) discussed the type of this species, and Bouček (1988) transferred it.

leai (Girault). AUSTRALIAN: Australia (South Australia).

Neomegastigmus leai Girault 1929/431:341. Holotype female, Kangaroo Island, South Australia, Australia (SAM).

TAXONOMY.—Dahms (1984) discussed the type of this species, and Bouček (1988) transferred it.

longifasciatus (Girault). AUSTRALIAN: Australia (Queensland).

Megastigmus (Bootanomyia) longifasciata Girault 1915/243:305. Holotype female, Gordonvale (Cairns), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1984) discussed the type of this species. Bouček (1988) transferred it and suggested that it is probably a synonym of *B. ashmeadi*.

nonvitta (Girault). AUSTRALIAN: Australia (New South Wales, Queensland [Bouček 1988]).

Epibootania nonvitta Girault 1938/450:81-82. Syntypes, Condova [Condong], New South Wales (QM, examined).

TAXONOMY.—Noble (1938a) redescribed the female and male of this species. Dahms (1986) discussed the types. Bouček (1988) transferred the species and suggested that it was possibly a paler form of *Bootanelleus nymphae*.

HOST.—The syntypes were reared from "citrus galls," which according to Noble (1933, 1935, 1936, 1938a) were caused by *Eurytoma* (now = *Bruchophagus*) *fellis* (Eurytomidae).

BIOLOGY.—Noble (1938a) discussed the biology of this species, which requires the presence of the gall-forming eurytomid. Only indirect evidence of parasitism was presented. Generally, the larva of *novitta* was found in proximity to larval and pupal remains of *Bruchophagus fellis*. Noble concluded that the presence of *novitta* "prevented" the eurytomid from emerging. He suggested that *novitta* could "spend the early portion of its life as a phytophagous larva and may not attack [*Bruchophagus*] *fellis* until the latter reaches either the mature larval or the pupal stage." He described and illustrated the egg and larva.

nymphæ (Girault). AUSTRALIAN: Australia (Queensland).

Epibootania nymphæ Girault 1937/448:1. Holotype female, Mt Tambourine, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type and Bouček (1988) transferred the species.

HOST.—The type was reared "from *Microcitrus*."

orientalis (Mathur and Hussey). ORIENTAL: India (Orissa; Tamil Nadu [Narendran 1994]).

AUSTRALIAN: Australia (NSW, Tasmania [Bouček 1988]), Fiji, Hawaii (Oahu [Bouček 1988]). NEARCTIC: United States (California, introduced [Bouček 1988]). NEOTROPICAL:

Cuba [Bouček 1988].

Bootanomyia orientalis Mathur and Hussey 1956:1-4 (Figs. 1-14). Holotype female, Puri, Orissa, India (FRI); 5 female paratypes, same data as holotype (FRI).

TAXONOMY.—Narendran (1994) redescribed and illustrated the female of this species.

HOSTS.—The types were reared from seeds of *Casuarina equisetifolia*. Specimens from Fiji

(Mathur and Hussey 1956) and Cuba (Bouček 1988) were reared from the same host. Bouček (1988) reported *Casuarina* (Australia) and *Casuarina stricta* (California, in seeds imported from Tasmania) as hosts.

DISTRIBUTION.—Although *orientalis* was originally described from India, the host plant, *Casuarina*, is native to Australia, and it is presumed that records from other areas constitute introductions.

pax (Girault). AUSTRALIAN: Australia (Queensland).

Megastigmus (Bootanomyia) pax Girault 1915/243:304. Holotype female, Gordonvale (Cairns), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species, and Bouček (1988) transferred it.

sanguiniventris (Girault). AUSTRALIAN: Australia (Northern Territory).

Megastigmus (Bootanomyia) sanguiniventris Girault 1915/243:306. Holotype female, Port Darwin, Northern Territory, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species, and Bouček (1988) transferred it.

victoriae (Girault). AUSTRALIAN: Australia (Victoria, New South Wales).

Bootanomyia victoriae Girault 1928/420:262. Syntypes(s), Ferntree [Fern Tree] Gully, Victoria, Australia (NMV, QM [examined]); 1 female "paratype", Albury, New South Wales, Australia (NMV).

TAXONOMY.—Dahms (1986) discussed the confusion surrounding types and Bouček (1988) transferred the species.

viridiscutellum Girault. AUSTRALIAN: Australia (Queensland).

Bootanelleus viridiscutellum Girault 1915/243:308. Holotype female, Capeville (Pentland), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species. Bouček (1988) stated that the head was "virtually destroyed." As all other species of the genus are defined in large part by the clypeus, it is unknown whether the type species of the genus shares this character or not.

Bootania Dalla Torre

Metamorpha Walker 1862:346. Type species: *Metamorpha leucospoides* Walker (monotypy).
Bootania Dalla Torre 1897:86. [Replacement name for *Metamorpha* Walker preoccupied by
 Metamorpha Huebner 1819.]
Spilomegastigmus Cameron 1905:73-74. Type species: *Spilomegastigmus ruficeps* Cameron
 (monotypy). [Synonymized by Bouček 1988:127.]
Eutanycornus Cameron 1909:209-210. Type species: *Eutanycornus pilicornis* Cameron
 (monotypy). [Synonymized by Bouček 1988:127.]
Pulvilligera Strand 1911a:59. Type species: *Pulvilligera maxima* Strand (original designation).
 [Synonymized by Riek in Kamijo 1962:36; confirmed by Bouček 1988.]
Macrodasyces Kamijo 1962:19, 34-36. Type species: *Megastigmus japonicus* Ashmead (original
 designation). [Synonymized by Bouček 1988:127.]

NUMBER OF SPECIES.—10.

DISTRIBUTION.—Widely distributed in the Old World from Japan (in the north) to Bhutan (in the
 west) to northeastern Australia and Fiji (in the south).

HOSTS.—Six species are associated with seeds of *Pandanus* and *Ilex*. The remainder have no host
 records.

KEYS TO SPECIES.—Narendran (1994) gave a key to the 2 species known to occur in India. Kamijo
 (1962) gave a key to 2 species that attack *Ilex* in Japan.

gigantea (Girault). AUSTRALIAN: Australia (Queensland).

Pulvilligera gigantea Girault 1928/421:3. 1 female syntype, Townsville, Queensland,
 Australia (QM, examined); 1 male syntype, same data as female (lost according to
 Dahms 1984).

TAXONOMY.—Riek (1970:920) transferred this species and Dahms (1984) discussed the
 types.

HOST.—The species was reared from *Pandanus* fruit (Bouček 1988).

hirsutum (Kamijo). PALEARCTIC: Japan.

Macrodasyces hirsutum Kamijo 1962:37-38. Holotype female, Abiko, Chiba Perf.
 Honshu, Japan (HU); 1 female paratype, same data as holotype (HU).

TAXONOMY.—Kamijo (1981) described and illustrated the male of this species. He gave a
 key to distinguish *hirsutum* from *japonicus*.

HOST.—Kamijo (1981) first reported the host of this species as seeds of *Ilex integrifolia*.

BIOLOGY.—This species has two generations per year (Kamijo 1981). Adults laid eggs in
 late May and June. Adults emerged in August and oviposited in still immature seeds.
 The mature larva overwintered in the seed and emerged the following year.

japonicus (Ashmead). PALEARCTIC: Japan.

Megastigmus japonicus Ashmead 1904:146. 10 syntype females, Gifu, Japan (USNM,
 examined).

TAXONOMY.—Kamijo (1962) transferred the species to his new genus *Macrodasyces*, and
 Bouček (1988) synonymized that genus with *Bootania*. Kamijo (1962) illustrated and
 redescribed the female and described the male for the first time. Kamijo (1981) gave a
 key to distinguish *japonicus* from *hirsutum*. Zerova and Seryogina (1994) redescribed
 both sexes and illustrated the female habitus.

HOST.—Kamijo (1962) reared specimens from seeds of *Ilex shinensis* (now = *purpurea*) and *I. serrata*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the host plant with fruit.

leucospoides (Walker). ORIENTAL: Bhutan; Burma (Bouček 1988).

Metamorpha leucospoides Walker 1862:347. Lectotype female, "Bootan" (BMNH, designated by Bouček 1988:127).

Metamorpha leucaspidoidea Walker: Rye 1874:362, incorrect subsequent spelling.

TAXONOMY.—Milliron (1949:348) discussed the nomenclature of this name and stated that *leucaspidoidea* was incorrectly credited to Westwood (1874) by Dalla Torre (1898) when it should have been credited to Zoological Record (= Rye 1874). Narendran (1994) redescribed the lectotype.

DISTRIBUTION.—According to Bouček (1988) the record for this species is questionably Butung Island, SE of Celebes (= Sulawesi). Narendran (1994) disagreed with this interpretation and so do I. Harper's Gazetteer of the world (Smith 1855) listed Bootan (also spelled Bhotan) as the area that now corresponds to Bhutan, and I see no reason to suggest otherwise. Bouček (1988) stated that the locality of Assam (India) given by Dalla Torre (1898) from uncited sources is incorrect, but Assam borders Bhutan on the south and east so that the locality is likely to be correct.

maxima (Strand). ORIENTAL: Taiwan. AUSTRALIAN: Solomon Islands (Guadalcanal [Milliron 1950]).

Pulvilligera maxima Strand 1911a:59. 6 syntype males, Taihanroku, Taiwan (ZMB, examined, in part).

TAXONOMY.—The female was described (and males redescribed) by Milliron (1950) from non-type material reared from Guadalcanal. Milliron saw no type material, yet he stated that the "type" was "one of six males." Bouček (1988) stated that he "examined the holotype" of this species in the Berlin Museum. I have seen 3 specimens from ZMB, and it appears as if these are all syntypes. The species was transferred by implication to *Bootania* by Kamijo (1962).

HOST.—The male was reared from seeds of *Pandanus upoluensis* from Guadalcanal (Milliron 1950).

neocaledonica (Milliron). AUSTRALIAN: New Caledonia, Fiji (Milliron 1950).

Pulvilligera neo-caledonica Milliron 1950:350-352 (Figs. 4-5). Holotype female, Poindimie, New Caledonia (USNM, examined); 2 male, 2 female paratypes same data as holotype.

TAXONOMY.—Bouček (1988) transferred the species.

HOST.—The types were reared from *Pandanus tectorius neocaledonicus*.

pilicornis (Cameron). ORIENTAL: Malaysia (Borneo, Sarawak).

Eutanycomus pilicornis Cameron 1909:210. Lectotype female [designated by Bouček 1988:127], Kuching, Borneo (BMNH, according to Bouček 1988). 1 male ?paralectotype, Quop, Sarawak (BMNH, Bouček 1988).

TAXONOMY.—Bouček (1988:127) discussed the problems involved with selecting a lectotype for this species. It is not clear if the male should be considered a paralectotype.

ruficeps (Cameron). ORIENTAL: Sri Lanka.

Spilomegastigmus ruficeps Cameron 1905:74. Lectotype female [designated by Bouček 1988:127], Kandy, Sri Lanka (BMNH, according to Bouček 1988).

TAXONOMY.—Bouček (1988) transferred the species. Narendran (1994) redescribed the lectotype female.

solomonensis (Milliron). AUSTRALIAN: Solomon Islands (Guadalcanal).

Pulvilligera solomonensis Milliron 1950:352-354 (Figs. 6-7). Holotype female, Mouth of Tenaru River, Guadalcanal, Solomon Islands (USNM, examined); 44 female, 24 male paratypes same data as holotype.

TAXONOMY.—Bouček (1988) transferred the species.

HOST.—The types were reared from *Pandanus* seed.

titanus (Girault). AUSTRALIAN: Papua New Guinea.

Epimegastigmus titanus Girault 1939/455:147-148. Holotype female, Southeast Papua (QM).

TAXONOMY.—Milliron (1949) transferred this species to *Megastigmus* and Bouček (1988) transferred it to *Bootania*.

Bootanomyia Girault

Bootanomyia Girault 1915/243:304 (subgenus of *Megastigmus* Dalman). Type species: *Megastigmus (Bootanomyia) smaragdus* Girault (original designation).

Epibootania Girault 1937/448:1. Type species: *Epibootania guttatifennis* Girault (original designation). [Synonymized by Bouček 1988.]

NUMBER OF SPECIES.—4.

DISTRIBUTION.—A few species are known from the Philippines and Australia.

HOST.—Unknown.

TAXONOMY.—*Bootanomyia* was elevated to generic rank by Girault 1928/420: 262.

KEYS TO SPECIES.—No keys have been published.

gemma Girault. ORIENTAL: Philippine Islands (Luzon).

Bootanomyia [sic] *gemma* Girault 1928/425:450. Holotype female, Baguio, Benguet, Luzon, Philippine Islands (QM).

guttatifennis (Girault). AUSTRALIAN: Australia (Queensland).

Epibootania guttatifennis Girault 1937/448:1. Lectotype female [designated by Bouček 1988:129], Kuranda, Queensland (QM, examined).

TAXONOMY.—Dahms (1984) discussed the type of this species (as "holotype") and Bouček (1988) transferred it.

smaragdus (Girault). AUSTRALIAN: Australia (Queensland).

Megastigmus (Bootanomyia) smaragdus Girault 1915/243:304. Holotype female, Roma, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type, and Bouček (1988) transferred the species.

viridiscutellum (Girault). AUSTRALIAN: Australia (Queensland).

Megastigmus (Boatanomyia) viridiscutellum Girault 1915/243:304. Holotype female, Gordontale (Cairns), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type and Bouček (1988) transferred the species.

Bortesia Pagliano and Scaramozzino

Xenostigmus Riek 1966:1200. Type species: *Xenostigmus mirostigmus* Riek (original designation).

Bortesia Pagliano and Scaramozzino 1990:5. New replacement name for *Xenostigmus* Riek 1966, preoccupied by *Xenostigmus* Smith 1944.

NUMBER OF SPECIES.—3.

TAXONOMY.—Although Pagliano and Scaramozzino (1990) created a new replacement name for *Xenostigmus*, the only species they actually transferred was *X. mirostigmus*. Therefore the remaining two species formally were not transferred, and I do so below.

DISTRIBUTION.—The known species are from Australia.

HOSTS.—All species are thought to cause galls in buds of *Hakea* species, but this has not been corroborated by study.

KEY TO SPECIES.—Riek 1966:1200.

longistigmus (Riek). New combination. AUSTRALIAN: Australia (New South Wales).

Xenostigmus longistigmus Riek 1966:1203-1205 (Figs. 2, 5, 8). Holotype female, Kariong, New South Wales, Australia (ANIC); 1 paratype female, same data as holotype (Forestry Commission of NSW).

HOST.—The types were reared from a bud-gall on *Hakea dactyloides*.

mirostigmus (Riek). AUSTRALIAN: Australia (New South Wales; West Australia and South Australia [Bouček 1988]).

Xenostigmus mirostigmus Riek 1966:1201-1203 (Figs. 1, 4, 7). Holotype female, Kariong, New South Wales, Australia (ANIC); 80+ paratype females and males from same locality (ANIC, Forestry Commission of NSW, Sydney).

TAXONOMY.—Bouček (1988) illustrated the forewing of this species.

HOST.—The holotype was reared from bud-galls on *Hakea dactyloides* and the paratypes from *H. teretifolia*.

similis (Riek). New combination. AUSTRALIAN: Australia (New South Wales).

Xenostigmus similis Riek 1966:1205-1206 (Figs. 3, 6, 9). Holotype female, Strahorn State Forest, New South Wales, Australia (ANIC).

HOST.—The holotype was reared from "pineapple bud-gall" on *Hakea leucoptera*.

Ianistigmus Bouček

Ianistigmus Bouček 1988:132-133. Type species: *Ianistigmus tatianae* Bouček (original designation and monotypy).

NUMBER OF SPECIES.—1.

DISTRIBUTION.—The only known species is from Australia.

HOST.—Unknown.

KEYS TO SPECIES.—No keys have been published.

tatianae Bouček. AUSTRALIAN: Australia (Queensland).

Ianistigmus tatianae Bouček 1988:133. Holotype female, Carr Creek NNW of Mareeba, Queensland, Australia (ANIC); 1 female paratype, Fraser Island, Queensland, Australia (QM [not here]); 1 female paratype, Kuranda, Queensland, Australia (BMNH).

TAXONOMY.—Bouček (1988) illustrated the forewing, body, scutellum, and mouth of this species. When I examined the Queensland Museum collection (1999), the paratype was not present.

Malostigmus Bouček

Malostigmus Bouček 1988:126-127. Type species: *Bootanomyia pergrata* Girault (original designation and monotypy).

NUMBER OF SPECIES.—1.

DISTRIBUTION.—A single species is known from Australia.

HOST.—Unknown.

KEYS TO SPECIES.—No keys have been published.

pergratus (Girault). AUSTRALIAN: Australia (Queensland; New South Wales [Bouček 1988]).

Bootanomyia pergratus Girault 1915/243:304. Holotype female, Gordonvale, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type specimen of this species. Bouček (1988) illustrated the female habitus and male antenna (1988).

Mangostigmus Bouček

Mangostigmus Bouček 1986:396-397. Type species: *Neomegastigmus amraeus* Kurian (original designation).

NUMBER OF SPECIES.—1.

DISTRIBUTION.—A single species is known from India and Borneo.

HOST.—Reared from a cecidomyiid that forms galls on mango leaves.

KEYS TO SPECIES.—Included in a key to chalcidoid wasps associated with mango (Bouček 1986).

amraeus (Kurian). ORIENTAL: India (Uttar Pradesh; Kerala [Narendran 1994]), Thailand, Malaysia, Brunei (all Bouček 1986), Borneo (Bouček 1988).

Neomegastigmus amraeus Kurian 1953:241-246 (Figs. 1-10). Holotype female, Dehra Dun, India (St. John's College, Agra); 1 female, 2 male paratypes, same data as holotype.

TAXONOMY.—The species was illustrated by Bouček (1986). Narendran (1994) redescribed and illustrated the female.

DISTRIBUTION.—According to Bouček (1988), this species may eventually be found in Australia and wherever mango is planted.

HOST.—The types were reared from galls caused by *Anradiplosis* (now = *Procontarinia echinogalliperda* (Cecidomyiidae) on *Mangifera indica*.

Megastigmus Dalman

Megastigmus Dalman 1820:178 (Synopsis 2, as subgenus of *Torymus* Dalman). Type species: *Pteromalus bipunctatus* Swederus (designated by Crosby 1913:155).

Cycloneuron Dahlbom 1857:295. Type species: *Ichneumon dorsalis* Fabricius (designated by Graham 1990:199). [Synonymized by Graham 1990:199]

Trogocarpus Rondani 1877:204. Type species: *Trogocarpus ballestrerii* Rondani (original designation, monotypy). [Synonymized by De Stefani 1917:101]

Megalostigmus Schultz 1906:147. Unnecessary emendation of *Megastigmus* Dalman.

Xanthosomoides Girault 1913/148:220-221. Type species: *Xanthosomoides maculatipennis* Girault (original designation). [Synonymized by Girault 1915/243:297]

Epimegastigmus Girault 1915/243:307 (as subgenus of *Megastigmus* Dalman). Type species: *Xanthosomoides fulvipes* Girault (original designation). [Synonymized by Milliron 1949:263]

Eumegastigmus Hussey 1956a:157-158. Type species: *Eumegastigmus hypogea* Hussey (original designation). [Synonymized by Bouček 1978:129]

NUMBER OF SPECIES.—126.

DISTRIBUTION.—Species of *Megastigmus* are found throughout the world (Table 3), but are uncommon in the Afrotropical and Oriental Regions, and are essentially absent in the Neotropical Region. The regions of greatest species diversity are the Australian and the Palearctic with nearly 80% of all known taxa.

CATALOGS.—Most of the inclusive catalogs covering this genus were listed in the introductory section of this paper. Two additional listings are Wall 1984 (23 species and their hosts found in Central Europe), Wisniewski 1997 (10 species in Poland).

BIOLOGY AND HOSTS.—Milliron (1949) gave an interesting and complete account of the discovery and history of the plant feeding behavior in this genus. He also reviewed the biology of many species known up to that time. The genus has four basic types of feeding behaviors as mentioned in the introductory section: 1) Strict phytophagy within the seeds of a number of plant families (see summary below). [For the most part, it has been assumed that these are fertile seeds, but according to Scurlock et al. (1982), Niwa and Overhulser (1992), and Rappaport et al. (1993) several species of *Megastigmus* are known that attack and develop in unfertilized seeds. Therefore, one might presume that this phenomenon is more common than reported.] 2) Facultative parasitoid that requires a gall-former but feeds on plant tissue within the gall as well. 3) Obligate egg-larval or larval endoparasitoid of gall-forming

Hymenoptera (e.g., Eurytomidae, Pteromalidae, Cynipidae). 4) Gall-former (personal observation). Most of the literature about biology and hosts is widely scattered but much of it is summarized below under the appropriate species. Turgeon et al. (1994) gave a generalized review of insects attacking coniferous seeds, which included some general information about *Megastigmus* and its interactions with cones. Roques (1983) and Roques and Skrzypczynska (in prep.) summarized the world hosts of phytophagous *Megastigmus* and provided many citations to the literature on distribution and host relations. Yates (1986) listed *Megastigmus* species associated with world conifers. Based on the literature, seeds of the following 8 plant families are known as hosts for *Megastigmus* (Table 4): Anacardiaceae, Aquifoliaceae, Cupressaceae, Fabaceae, Hamamelidaceae, Pinaceae, Rosaceae, and Taxodiaceae. The plant families Poaceae and Asteraceae have also been reported, but the validity of these hosts is questionable based on infrequency and the tentative nature of the reports. By far the greatest number of hosts are in the families Pinaceae and Rosaceae (Table 4). Twenty-seven genera of plants are known as positive hosts for *Megastigmus* (see Host List).

MORPHOLOGY.—Morphological papers treating particular species are listed under those species. Sellenschlo (1983b) compared unspecified *Megastigmus* larvae with those of *Torymus*.

KEYS TO SPECIES.—There are many keys to species of this genus, but most are rather fragmentary in coverage. The following are some of the more easily available and useful guides to the genus (arranged by region, then date): Afrotropical: Hussey 1956a (4 species classified as *Eumegastigmus*). AUSTRALIAN: Girault 1915/243 (15 species as *Megastigmus* and *Epimegastigmus*). Nearctic: Crosby 1913 (9 species); Marcovitch 1914 (10 species); Milliron 1949 (19 species). Palearctic: Seitner 1916 (12 European species); Hoffmeyer 1931 (17 European species and subspecies); Laidlaw 1931 (4 Scottish species); Escherich 1938 (6 European species and subspecies, after Hoffmeyer 1931); Kangas 1945 (6 European species); Nikol'skaya 1952 (18 western Palearctic species); Erdös 1960 (15 species of Hungary and surrounding areas); Kamijo 1962 (Japanese species in Phytophagous Group (10 species) and Entomophagous Group (2 species)); Hussey 1962 (species from seeds of *Larix*); Nikol'skaya 1966b (6 species associated with *Juniperus*); Bouček 1970b (12 west-European species); Nikol'skaya and Zerova 1978 (14 species from European part of former USSR); Jespersen and Lumholdt 1983 (9 Danish species); Karnowski 1988 (species from forest trees in Poland); Doganlar 1989 (9 entomophagous species); Zerova and Seryogina 1994 (3 seedling-feeding species groups, and 25 species); Roques and Skrzypczynska (in prep.) (13 native and 7 introduced species in Europe).

ARRANGEMENT.—In the following list, subspecies follow the nominal species name.

acaciae Noble. AUSTRALIAN: Australia (New South Wales).

Megastigmus sp. Noble 1938b:408.

Megastigmus acaciae Noble 1939b:266-268. Holotype female, Lindfield, Sydney, New South Wales, Australia (BMNH). 11 female, 12 male paratypes same data as holotype (BMNH, USNM [examined]).

HOST.—The types were reared from galls of *Tepperella trilineata* (now = *Perilampella hecataeus*) (Pteromalidae) on *Acacia decurrens pauciglandulosa*. [This host was first mentioned by Noble (1938b) for an unnamed species of *Megastigmus* that he described in 1939b as *acaciae*.]

BIOLOGY.—Noble (1938b, 1939a,b) discussed the biology of this entomophagous species (though most of the information is contained in 1939b). In spring (October or November) *M. acaciae* laid its eggs either within the egg or first instar larva (Noble could not determine which) of the gall-former in buds. One or two *acaciae* larvae could

be found within a single host larva, but by the host's fifth instar only one parasitoid remained. The host matured in about eight months, at which point it was consumed by *acaciae*. There was one generation per year. Noble (1939b) figured the adults and larvae.

PARASITES.—*Eurytoma gahani* (Eurytomidae) was a facultative parasite of *M. acaciae* (Noble 1940).

aculeatus (Swederus). PALEARCTIC: Widely distributed throughout Europe and Russia east to Japan (Roques and Skrzypczynska in prep.), China (Milliron 1949, Xu and He 1995), Iran (Milliron 1949). AFROTROPICAL: Somalia (Milliron 1949). NEARCTIC (introduced): United States (Massachusetts, New York [Milliron 1949]). AUSTRALIAN (introduced): Australia (Bouček 1988), New Zealand (Noyes and Valentine 1989).

Pteromalus aculeatus Swederus 1795:221-222. Female (number unknown), "Uplandia", Sweden (depository unknown).

Megastigmus transversus Walker 1833:117. Holotype female, "near London," England (BMNH). [?Synonymized with *collaris* by Mayr 1874:137]

Torymus (Megastigmus) collaris Dalman 1820: [Described in table without page number]

Torymus collaris Boheman 1834:332. Female and male syntypes (number unknown), "Smolandia, Westrogothia, et Scania" (depository unknown). [?Synonymized by Dalle Torre 1898:285]

Torymus punctum Förster 1840:31. Holotype female, Germany (?NMW). [?Synonymized with *collaris* by Mayr 1874:137]

Megastigmus vexillum Ratzeburg 1848:182. [*Nomen nudum*] [?Synonymized with *collaris* by Mayr 1874:137]

Megastigmus flavus Förster 1859:109-110. Female and male syntypes (number not stated), Tyrol (female), Aachen (male), Germany (?NMW). [?Synonymized with *collaris* by Mayr 1874:137]

Megastigmus collaris flavus Förster: Mayr 1874:138. [Treated as subspecies]

Megastigmus cynorrhodi Perris 1876:222. [?Synonymized by Dalle Torre 1898:285]

Megastigmus aculeatus flavus Förster: Dalla Torre 1898:285. [Subspecies]

TAXONOMY.—The synonymy of this species is complex and it is not certain who proposed some of the combinations and synonymies cited above. I attempted to trace the first use of names and their subsequent synonymization, and above I inserted question marks to indicate probable authorities. Crosby (1909, 1913) redescribed and illustrated adults of both sexes. Balduf (1959) illustrated the adult female. Hoffmeyer (1930) illustrated the female stigma (as *aculeatus flavus*). The nominate species was redescribed by Milliron (1949) who illustrated the forewing stigma. Kamijo (1962) illustrated the ovipositor. Zerova and Seryogina (1994) redescribed and illustrated both sexes of this species as did Roques and Skrzypczynska (in prep.).

HOSTS.—This species was originally thought to be a parasite of tephritid flies in rose hips (Ratzeburg 1848, Mayr 1874), but Perris (1876) considered it likely that *aculeatus* was phytophagous. Wachtl (1884a) first proved that *aculeatus* was phytophagous. Balduf (1959) gave an extensive summary of the history of biological discovery for this species. The species is widely distributed in seeds of *Rosa* spp. which are summarized by Roques and Skrzypczynska (in prep.) along with a great number of literature citations. The known hosts are *Rosa alpina* (now = *pendulina*), *R. arvensis*, *R. beggeriana*, *R. canina*, *R. cinnamomea* (now = *pendulina*), *R. collina*, *R. davurica*, *R. ferruginea*, *R. gallica*, *R. glutinosa* (now = *pulverulenta*), *R. jundzilli*, *R. mollissima*, *R. montana*, *R. multiflora*, *R. pendulina*, *R. pouzinii*, *R. rubiginosa*, *R. rugosa*, *R.*

spinosissima (now = *pimpinellifolia*), *R. turkestanica*, and *R. villosa* (now = *carolina villosa*).

BIOLOGY.—Crosby (1909) stated that overwintering took place as mature larvae which pupate in the spring. He illustrated the larva and its mandibles as well as rose seeds showing exit holes. Balduf (1959) reviewed the literature associated with the biology of this species. According to Roques and Skrzypczynska (in prep.), males of this species are rare and it reproduces by thelytokous parthenogenesis. Zerova and Seryogina (1994) illustrated seed damage caused by this species.

MORPHOLOGY.—Domenichini (1953) presented a comprehensive and well-illustrated overview of the abdominal morphology of this species.

ECONOMIC IMPORTANCE.—Balduf (1959) reviewed literature concerning the introduction of this species into the Nearctic in seeds of *Rosa multiflora*. At one point this rose was considered economically important in the creation of fencerows, as protection for wildlife, and as an ornamental shrub. At first, *Megastigmus aculeatus* was considered a pest hindering the production of this rose species. Multiflora rose is now considered a pest, and its seed-feeding wasp may be considered of value in controlling its spread.

aculeatus nigroflavus Hoffmeyer. PALEARCTIC: Japan, Russia [Milliron 1949]. NEARCTIC (introduced from Japan [Weiss 1917, Milliron 1949]): United States (New Jersey, Virginia).

Megastigmus aculeatus nigroflavus Hoffmeyer 1929:324-325 (Figs. 1-4). Holotype female, Japan (Hoffmeyer Collection); about 800 female, and 25 male paratypes, same data as holotype (ZMUC, USNM [examined]).

TAXONOMY.—Hoffmeyer did not state explicitly that all specimens he examined other than the holotype were paratypes, but this would seem to be the only interpretation based upon his text. This species was redescribed by Milliron (1949) who illustrated the forewing stigma.

HOSTS.—The types were reared from seeds of *Rosa multiflora*. Milliron (1949) also listed *Rosa gallica* as a host.

adelaidensis Girault. AUSTRALIAN: Australia (South Australia).

Megastigmus adelaidensis Girault 1915/243:301. Holotype female, Adelaide, South Australia (QM, lost according to Dahms 1983).

TAXONOMY.—Dahms (1983) discussed the type.

HOST.—Reared from an unidentified gall.

albifrons Walker. NEARCTIC: United States (California, Arizona). NEOTROPICAL: Mexico (south to states of Michoacán, México, and Tlaxcala [Cibrián-Tovar et al. 1986]); Guatemala (De Santis 1989).

Megastigmus albifrons Walker 1869:314. Holotype male, California, USA (BMNH).

Megastigmus grandiosus Yoshimoto 1979:201-203 (Figs. 1-9; 10-13 [as *albifrons*]). Holotype female, Calpulalpam, Tlaxcala, Mexico (CNC); 19 female, 19 male paratypes same data as female; 1 female paratype, "Avila Gonadan," Mexico; 1 female, 1 male paratype, "Sta. Tomas, Aplplilihung," Mexico (CNC, USNM [examined], ZMH, ENA). [Synonymized by Grissell 1985:351.]

TAXONOMY.—Crosby (1913) described the female and illustrated the male stigma. Keen (1938, repeated 1958) illustrated female and male adults, larvae, and pupae of this species. Milliron (1949) redescribed both sexes and illustrated the forewing stigma. Cibrián-Tovar et al. (1995) gave photographs of the adult female and larva.

HOSTS.—The type of *albifrons* reportedly was reared from a "fir cone" but this is in error considering subsequent records. The types of *grandiosus* were reared from seeds of *Pinus montezumae*, *P. rufa* (now = *hartwegii*), *P. ayacahuite*, and *P. hartwegii*. Milliron (1949) reported this species from seeds of *Pinus ponderosa* Laws. Cibrián-Tovar et al. (1995) listed the following additional hosts: *Pinus arizonica*, *P. ayacahuite brachyptera* (now = *strobiformis*), *P. ayacahuite veitchii*, *P. engelmannii*, *P. michoacana* (now = *devoniana*), *P. pseudostrobus*, and *P. contorta murrayana*.

BIOLOGY.—Keen (1938) illustrated a female ovipositing into a cone (repeated 1958), and later (1958) illustrated larvae in the cross-section of a pine cone (see also Dowden 1950, Cibrián-Tovar et al. 1986, 1995, Kinzer et al. 1972). According to Keen (1958), eggs are probably laid in immature first-year cones in March or April but do not complete development until the second fall when the cones mature. Mature larvae were found in the fall in fully mature seeds, and pupae formed from October to November. Adults emerged the following February through March with less than 1 percent emerging the next spring. Cibrián-Tovar et al. (1986, 1995) illustrated damaged cones and discussed the life cycle. There was one generation per year, but a small portion of the larvae remained in diapause for more than one year. Oviposition was through the scales into immature cones. Several eggs could be laid per seed, but only one larva completed development. Similar findings were made by Kinzer et al. (1972).

ECONOMIC IMPORTANCE.—Keen (1958) reported damage to seed of *Pinus ponderosa* at about 25%, and Kinzer et al. (1972) placed damage at an average of 43% (range 0 to 100% for 6 localities over 3 years).

PARASITES.—A species of *Tetrastichus* (Eulophidae) was reported as a possible parasite of *M. albifrons* (Keen 1958).

albizziae Mukerji. ORIENTAL: India (Delhi; Tamil Nadu [Narendran 1994]).

Megastigmus albizziae Mukerji 1950:130-132 (Figs. 1-11). Holotype female, "environs Delhi" (IARI); several paratypes of both sexes, same data as holotype (IARI).

TAXONOMY.—The female and male were redescribed by Narendran (1994:30-31). In a table, Narendran and Sureshan (1988) compared this species to *M. viggianii*.

HOSTS.—The types were reared from seeds of *Albizia odoratissima*. Narendran (1994) reported the host *Albizia lebbeck*.

almusiensis Doganlar. PALEARCTIC: Turkey.

Megastigmus almusiensis Doganlar 1989:199-200 (Figs. 1-4, 8). Holotype female, Almus, Tokat, Turkey (Doganlar Collection); 10 female, 15 males same data as holotype (Doganlar Collection, BMNH).

TAXONOMY.—Doganlar (1989) compared this species to *M. dorsalis* which he illustrated.

HOST.—The types were reared from galls of *Neuroterus macropterus* (Cynipidae) on *Quercus cerris*.

amamoori Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus amamoori Girault 1925/391:2. Holotype female, Amamoor, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1983) discussed the type of this species.

amelanchieris Cushman. NEARCTIC: United States (West Virginia; Minnesota, New Hampshire, New York, Pennsylvania, Vermont [Milliron 1949]).

Megastigmus amelanchieris Cushman 1918:81-82. Holotype female, Pickens, West Virginia, USA (USNM, examined). Paratypes (described from "a considerable series" of which 18 females, 2 males are in USNM), French Creek, West Virginia, and North East, Pennsylvania, USA (USNM).

TAXONOMY.—This species was redescribed by Milliron (1949) who illustrated the forewing.

HOSTS.—The types were reared from seeds of *Amelanchier canadensis*. Milliron (1949) reported it from *Amelanchier laevis x humilis*, *A. sanguinea*, and *Sorbus aucuparia*.

BIOLOGY.—Cushman (1918) (repeated by Milliron 1949) discussed the biology of this species and illustrated the mature larva, its mandibles, and the pupa. Oviposition occurs in late May and early June after which populations declined. Green fruits 3/16 to 1/4 inch were selected. Larvae were full grown after July 1. The fruits ripened and fell at this time; overwintering took place as mature larvae. Pupation occurred in spring and adults emerged in May. Males were uncommon.

PARASITES.—*Megastigmus amelanchieris* is parasitized by *Torymus amelanchieris* (Cushman) (Torymidae) (Crosby 1913), *Eupelmus urozonus* Dalman (Eupelmidae), and *Torymus aea* (Walker) (Torymidae) (Sellenschlo 1984a).

americanus Milliron. NEARCTIC: United States (New York); Canada (Ontario).

Megastigmus brevicaudis Ratzeburg of Crosby 1909:375-377 (misidentified male, female in part); Crosby 1913:156 (misidentified male, female in part); Gahan 1922:39 (misidentification).

Megastigmus slossonae Crosby 1913:157. [Nomen nudum]

Megastigmus americanus Milliron 1949:285-287 (Fig. 10). Holotype female, Ithaca, New York, USA (CU). 12 female, 8 male paratypes same data as holotype (CU).

TAXONOMY.—Crosby (1909, 1913) redescribed the female and male (as *brevicaudis*), as well as the mature larva and its mandible. He also illustrated the male and female wing veins.

HOST.—Milliron's holotype and paratypes were reared from seeds of *Sorbus "aucuparia"*, but he believed the species name to be in error. Milliron (1949) discussed the record of *Sorbus aucuparia* given by Crosby (1913) and concluded that it was probably incorrect based on the fact that *Sorbus aucuparia* was introduced from Europe. He suggested that some native species of *Sorbus* was the actual host.

amicorum Bouček. PALEARCTIC: "Widely distributed in the Mediterranean basin" (Roques and Skrzypczynska in prep.).

Megastigmus amicorum Bouček 1970a:37-39 (Figs. 1, 2). Holotype female, Biograd (nr. Zadar), Dalmatia, Yugoslavia (NMP). Numerous paratypes same data as holotype, and Sandanski, Bulgaria.

TAXONOMY.—Zerova and Seryogina (1994) and Roques and Skrzypczynska (in prep.) redescribed and illustrated the habitus of both sexes. Sellenschlo (1983a) gave a scanning electron micrograph of the metasomal dorsum.

HOSTS.—The types were reared from seeds of *Juniperus oxycedrus*. Roques and Skrzypczynska (in prep.) reported *J. phoenicea* and *J. thurifera* (in Corsica) and said that *J. excelsa* might be a host. They also stated that *M. amicorum* had host-shifted to introduced *Cupressus arizonica* and *C. goveniana*.

BIOLOGY.—Sellenschlo (1984b) illustrated the egg and larva of this species and discussed

its development. Adults emerged in July and August and oviposition occurred from August to September. Sellenschlo (1983a) illustrated the female ovipositing into a cone of *Juniperus* and Zerova and Seryogina (1994) illustrated the damaged cones. Larvae overwintered in the third instar. The species has a balanced sex ratio (Roques and Skrzypczynska in prep.).

asteri Ashmead. AUSTRALIAN: Australia (New South Wales).

Megastigmus asteri Ashmead 1900:332-333. 3 female, 2 male syntypes, Sydney, New South Wales, Australia (USNM, examined).

TAXONOMY.—The description was repeated by Girault (1915/243).

HOST.—The type series was reared from a dipterous gall on snowbush, *Aster ramulosus*.

atedius Walker. PALEARCTIC (introduced): Widespread in Europe (Roques and Skrzypczynska in prep.). NEARCTIC: United States (widespread in the northern and western states [Roques and Skrzypczynska in prep.] and Alaska [Keen 1958]), Canada (widespread [Roques and Skrzypczynska in prep.]).

Megastigmus atedius Walker 1851:214. Holotype female, [Glanville's Wootton, Dorsetshire], England (OUM, according to Hussey 1954, Bouček 1970b).

Megastigmus piceae Rohwer 1915:97-98. Holotype female, Crescent City, California, USA (USNM, examined); 1 male paratype, same data (USNM). [Synonymized by Bouček 1970b:265.]

Megastigmus zwolferi Schefer-Immell 1957:53-56 (Figs. 2-5). Female and male syntypes, Gammelsbach, Beerfelden, Odenwald (Forstzoologischen Institutes der Universität Göttingen, Hann., Münden). [Synonymized by Bouček 1970b:265.]

TAXONOMY.—This species (as *M. piceae*) was redescribed by Milliron (1949) who illustrated the forewing stigma. Hussey (1954) also redescribed the female. Bouček (1970b) illustrated the mesoscutum in comparison to *M. strobilobius*. Zerova and Seryogina (1994) redescribed both sexes and illustrated the female (habitus). Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male.

HOSTS.—The type of *M. piceae* was reared from seeds of *Picea sitchensis*. Additionally, Milliron (1949) reported *P. engelmannii*, *P. parryana*, and *P. pungens*. Additional North America reported hosts are: *Picea glauca*, *P. nigra*, and *Pinus strobus* (summarized by Roques and Skrzypczynska in prep.). In Europe *atedius* attacks host species introduced from North America including *Pinus strobus*, *P. contorta murrayana*, *Picea sitchensis*, and *P. engelmanni* (Roques and Skrzypczynska in prep.). It also host-shifted to the oriental spruce *Picea orientalis* and *Picea excelsa* (now = *abies*) (Bouček 1970b).

BIOLOGY.—Schefer-Immell (1957) illustrated the larva (and its mandibles) as well as seeds with emergence holes. Keen (1958) briefly discussed the emergence of this species (as *M. piceae*). The larvae develop during summer and fall, and apparently overwinter as pupae. Adults emerge from April to June of the following year. Five to thirty percent emerge the second spring. The sex ratio is variable, as reviewed by Roques and Skrzypczynska (in prep.).

atedius montana Milliron. NEARCTIC: United States (Montana).

Megastigmus picea montana Milliron 1949:305-306. Holotype female, Haugan, Montana, USA (USNM, examined). 1 female, 2 male paratypes, same data as holotype (USNM).

HOST.—All types were reared from seeds of *Picea engelmannii*.

ater (Girault). AUSTRALIAN: Australia (South Australia).

Neomegastigmus ater Girault 1927/416:331-332. Numerous syntypes, Blakiston, South Australia, Australia (QM [examined], SAM).

TAXONOMY.—Dahms (1983) discussed the complex series of syntypes associated with this species, and Bouček (1988) transferred it.

HOST.—The syntypes were reared from leaf-galls on *Eucalyptus obliqua*.

banksiae (Girault). AUSTRALIAN: Australia (South Australia).

Epimegastigmus banksiae Girault 1929/431:341. Holotype female, the Grange, South Australia, Australia (SAM).

TAXONOMY.—Dahms (1983) discussed the type specimen of this species. Milliron (1949) transferred the species to *Megastigmus*.

HOST.—The holotype was reared from unidentified galls on *Banksia*.

bipunctatus (Swederus). PALEARCTIC: Widely distributed over Europe, extending to western Siberia (Roques and Skrzypczynska in prep.).

Pteromalus bipunctatus Swederus 1795:205. Sex and number unknown, ?"Uplandia", Sweden (depository unknown).

Torymus erythrothorax Nees 1834:65. Male sytype(s), locality unknown, (destroyed, see Graham 1988 for discussion of Nees' collection). [Dalla Torre 1898:286 provisionally synonymized this species.]

Megastigmus microspilus Thomson 1876:62. "Syntype female" [see Hansson 1991], Norrland, Sweden (MZL). [Synonymized by Hoffmeyer 1931:266]

Megastigmus microphilus Thomson, Dalla Torre 1898:287. [Emend.]

Megastigmus kuntzei Kapuscinski 1946:12-19, 120-129 (Figs. 1-59) [see Kapuscinski 1964:8-12, for English translation]. Holotype female, near Wisniowa, Myslenice, Cracow, Poland (Cracow Natural History Museum); female and male paratypes, number unspecified, from several different "forest districts" (at least several paratypes seen from Zoological Institute of Sciences, Warsaw, Poland, according to Hussey 1956b). [Synonymized by Nuorteva 1967:123.]

TAXONOMY.—Graham (1988) discussed the general fate of Nees' collections. Although he did not specifically discuss *M. erythrothorax*, from a general discussion it appears that the type(s) of this species are lost. Hoffmeyer (1931) illustrated the male and female stigmal veins (as *M. bipunctatus*). Kapuscinski (1946) redescribed the female and male [his paper including all descriptions, illustrations, and biological information was revised, updated, and published in English in Kapuscinski 1964]. Zerova and Seryogina (1994) redescribed and illustrated the habitus of both sexes. Roques and Skrzypczynska (in prep.) redescribed and illustrated females and males of this species.

HOSTS.—Kapuscinski (1946, 1964) reported his species *kuntzei* from *Juniperus communis*.

He reported *bipunctatus* from *Juniperus nana* (now = *communis alpina*) and *J. siberica* (now = *communis siberica*). This species also has been recorded from *J. sabina* (Roques 1983) and *J. thurifera* (Roques et al. 1984). It was reported from *Juniperus excelsa* (Schimitschek 1944), but Roques and Skrzypczynska (in prep.) suggested that this record refers to *Megastigmus amicorum*. Vikberg (1966) stated that records for Lepidoptera should be dismissed for this species.

BIOLOGY.—Kapuscinski (1946, 1964) published an extensive paper on the biology and ecology of this species (as *kuntzei*), including illustrations of all life stages and effects on the host cones. Vikberg (1966) illustrated oviposition and a larva eating its host.

According to Kapuscinski (1946, 1964), female wasps oviposited in July and August into immature juniper cones that usually contained three ovules. Vikberg (1966), however, stated that oviposition took place into two-year old cones, with emergence from three-year old cones. Wasps oviposited into the seed embryo. Larvae fed to autumn, hibernated, and then continued feeding in the spring. Vikberg (1966) found second or third-instar larvae in overwintering cones, but Dolgin (1993) stated that overwintering took place as second-instar larvae. Pupation took place in June and emergence occurred in July or August (Kapuscinski 1946, Vikberg 1966). There was one generation per year with the larva living up to 10 months. Zerova and Seryogina (1994) illustrated the damaged cones. Götsche (1976, 1977) discussed experiments on behavior in which adult females were attracted to yellow rhomboid shapes. They preferred unbelliferous flowers to any other. The sex ratio is balanced in this species (Roques and Skrzypczynska in prep.).

PARASITES.—This species was parasitized by *Trichomalus laevinucha* Thomson (Pteromalidae) (Kapuscinski 1946).

***borriesi* Crosby. PALEARCTIC: Japan.**

Megastigmus borriesi Crosby 1913:169 (Fig. 10). 2 syntype females, Japan (USNM, examined).

TAXONOMY.—Kamijo (1962) redescribed and illustrated the female as did Zerova and Seryogina (1994). The male is unknown.

HOSTS.—The holotype was reared from seeds of *Abies mariesii*. The species is also reported from seeds of *Abies sachalinensis*, *A. sikokiana* (now = *veitchii sikokiana*), and *A. veitchii* (Kamijo 1962). Stadnitskii et al. (1978) reported *Abies nephrolepis* as a host of *M. suspectus*, but Roques and Skrzypczynska (in prep.) stated that this record probably referred to *M. borriesi*.

***borus* Walker. AUSTRALIAN: Australia (Tasmania).**

Megastigmus Borus Walker 1839:5-6. Holotype female, Hobart Town, Van Diemen's Land, Tasmania (BMNH, but lost according to Bouček 1988).

TAXONOMY.—The original description was repeated by Girault 1915/243:298.

***brachychitonii* Froggatt. AUSTRALIAN: Australia (New South Wales).**

Megastigmus brachychitonii Froggatt 1905:233 (Fig. 4). Female, male syntypes (number not stated), "western New South Wales," Australia (depository unstated).

HOST.—The syntypes were reared from fleshy galls on twigs of the kurrajong tree, *Brachychiton populneum*.

BIOLOGY.—Froggatt (1905) believed that this *Megastigmus* fed on plant tissue thought to be induced by a fungus.

***brachyscelidis* Ashmead. AUSTRALIAN: Australia (New South Wales).**

Megastigmus brachyscelidis Ashmead 1900:333. 2 female, 2 male syntypes, Sydney, New South Wales, Australia (USNM, examined).

TAXONOMY.—The description was repeated by Girault (1915/243).

HOST.—The types were reared from *Brachyscelis crispa* (now = *Apiomorpha strombylosa*) (Eriococcidae).

brevicaudis Ratzeburg. PALEARCTIC: Germany, and found throughout Europe and extending to Siberia (Roques and Skrzypczynska in prep.). NEARCTIC (probably introduced): United States (Minnesota [Milliron 1949]).

Megastigmus brevicaudis Ratzeburg 1852:225. Female, number unknown, "probably at Eberswalde, Germany" (Milliron 1949), (type probably destroyed in WW II, see Graham 1969).

TAXONOMY.—Hoffmeyer (1931) illustrated female and male stigmal veins. The species was redescribed by Milliron (1949) who illustrated the forewing stigma. Zerova and Seryogina (1994) redescribed and illustrated the female, and Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male. *Sorbus aucuparia* was introduced from Europe into the Nearctic, and it is likely that *M. brevicaudis* is also introduced.

HOSTS.—The type specimen(s) was reared from mountain ash (*Sorbus*) berries. Ratzeburg suggested that it possibly attacked "*Cedidomyia*", but this is wrong based on subsequent rearings. The species has been reared from seeds of *Sorbus aucuparia* and *S. scandica* (now = *aria*) (Milliron 1949) as well as *Amelanchier ovalis* (Seitner 1916) and *A. spicata* (Vikberg 1966).

BIOLOGY.—Rodzianko (1908) published the first records. Overwintering takes place as mature larvae with pupation and emergence occurring in the spring. Males were uncommon (see also Roques and Skrzypczynska in prep.). Milliron (1949) made a few general notes, stating that the biology of this species was much like that of *Megastigmus amelanchieris*. In Minnesota, larvae were full grown by mid-summer, and infested fruit tended to fall to the ground at this time before ripening fully. Zerova and Seryogina (1994) illustrated seed damage caused by this species as did Skrzypczynska (1996).

MORPHOLOGY.—Domenichini (1953) presented a short description of the abdominal morphology of this species.

brevivalvus (Girault). AUSTRALIAN: Australia (Queensland).

Epimegastigmus brevivalvus Girault 1926/393:1. Numerous syntypes, Nerang, Queensland, Australia (QM, examined).

TAXONOMY.—Gahan (in Noble 1938b:7) transferred the species to *Megastigmus*. Dahms (1983) discussed the syntypes of this species.

HOST.—Noble (1933, 1935, 1938a) reported the host as *Eurytoma* (now = *Bruchophagus*) *fellis* (Eurytomidae), a gall-former on twigs of *Eremocitrus glauca*, grapefruit, and some other citrus. The species was used in Queensland and New South Wales in biological control attempts of *B. fellis* (Gibson and Gellatley 1968).

BIOLOGY.—Noble (1938a) described the biology of *M. brevivalvus*. The female laid one to four eggs within the egg of the eurytomid gall-former, which had been imbedded in a twig. The egg(s) of *M. brevivalvus* always hatched inside the first instar of the host where the parasite larva remained in the haemocoel for eight months until the eurytomid larva reached maturity. Then *M. brevivalvus* began feeding, killing the host larva as an endoparasite.

caperatus Milliron. NEARCTIC: Canada (Ontario).

Megastigmus caperatus Milliron 1949:306-307 (Fig. 17). Holotype female, Port Hope, Ontario, Canada (CNC).

HOST.—Unknown ("possibly a species of *Picea*", Milliron 1949:307).

carinus Xu and He. PALEARCTIC: People's Republic of China (Yunnan).

Megastigmus carinus Xu and He 1995: 250-251, 253 (Figs. 16-18). Holotype female, Luxi, Yunnan, People's Republic of China (ZAU); 2 male paratypes, same data as holotype (ZAU).

HOST.—The types were reared from seeds of *Cupressus duclouxiana*.

cecili Girault. AUSTRALIAN: Australia (South Australia).

Megastigmus cecili Girault 1929/431:339. 2 syntype females, Murray Bridge, South Australia, Australia (SAM).

TAXONOMY.—Dahms (1983) discussed the types of this species.

cellus Xu and He. PALEARCTIC: People's Republic of China (Zhejiang).

Megastigmus cellus Xu and He 1995:248-249, 253 (Figs. 9-11). Holotype female, Hangzhou, Zhejiang, People's Republic of China (ZAU).

HOST.—The type was reared from seeds of a conifer.

certus Nikol'skaya. PALEARCTIC: Kirgistan.

Megastigmus certus Nikol'skaya 1966a:411. Holotype female, Asku-Dzhabagly, Kirgistan (ZI); many female and male paratypes from numerous localities in Kirgistan (ZI).

TAXONOMY.—Zerova and Seryogina (1994) redescribed both sexes and illustrated the habitus of the female.

HOSTS.—Paratypes were reared from seeds of *Juniperus sabina*. Nikol'skaya (1966b) reported *Juniperus semiglobosa* as a host.

chamaecyparidis Kamijo. PALEARCTIC: Japan.

Megastigmus chamaecyparidis Kamijo 1958:31-32 (Fig. 1A-C). Holotype female, Otaki, Nagano Pref., Honshu, Japan (HU); 6 female paratypes, same data as holotype; 8 female, 13 male paratypes, Honshu (locality unknown) (HU).

TAXONOMY.—Zerova and Seryogina (1994) redescribed and illustrated both sexes.

HOST.—The types were reared from seeds of *Chamaecyparis obtusa*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the host cone.

cotoneastri Nikol'skaya. PALEARCTIC: Tadzhikistan.

Megastigmus cotoneastri Nikol'skaya 1952:106 (Figs. 187, 188). Female and male specimens described in key, "Tadzhikistan" (ZI).

HOSTS.—The original host for this species was given as "parasitic on cotoneaster seeds." The following seed hosts were summarized by Zerova and Seryogina (1994): *Cotoneaster dielsianus*, *C. insignis*, *C. nummularia*, *C. rhytidophyllus*, and *C. tauricus*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the seed damage caused by this species.

cryptomeriae Yano. PALEARCTIC: Japan. People's Republic of China (Zhejiang [He 1984]).

Megastigmus cryptomeriae Yano (in Yano and Koyama) 1918a:45 (also 1918b:373).

Syntypes, (number unknown), Japan (destroyed by fire according to Kamijo 1962:31).

TAXONOMY.—Hoffmeyer (1929) illustrated female and male stigmal veins. Kamijo (1962) redescribed and illustrated the female and male. Kapuscinski (1946, updated 1964) redescribed both sexes. Zerova and Seryogina (1994) redescribed both sexes and illustrated the female head.

HOST.—The types were reared from seeds of *Cryptomeria japonica* and *Chamaecyparis obtusa*. The species was reported from seeds of *Cryptomeria fortunei* by He (1984).

BIOLOGY.—Zerova and Seryogina (1994) illustrated the host cone.

cupressi Mathur. ORIENTAL: India (Himachal Pradesh).

Megastigmus cupressi Mathur 1955:91-92 (Figs. 1-17). Holotype female, Parbati Range, Kulu, East Punjab, India (FRI); numerous paratype specimens, same data as holotype (FRI).

TAXONOMY.—Narendran (1994:31-32) redescribed the female and male of this species.

HOST.—The type series was reared from seeds of *Cupressus torulosa*.

darlingi (Girault). AUSTRALIAN: Australia (New South Wales).

Megastigmus sp. B Noble 1940:34-35.

Epimegastigmus darlingi Girault 1940/460:105-107. 4 female syntypes, Sydney, New South Wales, Australia ("QM").

TAXONOMY.—Although the syntypes are supposed to be at the Queensland Museum (Dahms 1983), only a few slides of parts are there. The specimens seen by Dahms are now at the ANIC for no explainable reason. There is no doubt in my mind that Noble's (1940) sp. B is the same data as *darlingi*. This conclusion is based on host records, locality, dates, and comments by Girault (1940/460) concerning the acquisition and biology of this species as well as comments by Noble stating that Girault considered his taxon to be new. This match now associates a name with the figures and biological data given by Noble (1940), who described the adult female, egg, and mature larva in the context of presenting biological information based upon Girault's intent to describe the species. Bouček (1988) transferred *darlingi* to *Megastigmus*.

HOST.—The types were reared from flower galls of *Trichilogaster acaciaelongifoliae* (Pteromalidae) on *Acacia floribunda*.

BIOLOGY.—Noble (1940) reported that this species was phytophagous and lived in the cell of its host until the host reached its pupal stage, at which point the *Megastigmus* consumed it.

distylii Kamijo. PALEARCTIC: Japan.

Megastigmus distylii Kamijo 1979:9-11 (Figs. 7-10). Holotype female, Kirishima-Yama, Miyazaki-ken, Kyushu, Japan (HU); 22 female, 22 male paratypes with same data.

TAXONOMY.—Zerova and Seryogina (1994) redescribed and illustrated both sexes.

HOST.—The type series was reared from seeds of *Distylium racemosum*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the damaged seed.

dorsalis (Fabricius). PALEARCTIC: "Whole Europe" (Bouček 1977). ORIENTAL: India (Uttar Pradesh [Mani and Kaul 1972]; West Bengal [Kieffer 1905]).

Ichneumon dorsalis Fabricius 1798:231 (Nr. 218-19). Female, number unknown, France (?MNHN, Bosc Collection).

Megastigmus bohemani Ratzeburg 1848:182-183. Female, number unknown, Germany, (NMW, type probably destroyed in WW II, see Graham 1969).

Megastigmus xanthopygus Förster 1859:110. 2 female, 2 male syntypes, England (?NMW).

TAXONOMY.—Graham (1990) designated *dorsalis* as the type of *Cycloneuron* Dahlbom, which he then synonymized with *Megastigmus*. Narendran (1994:31) redescribed the female and male.

HOSTS.—The type(s) of *dorsalis* was reared from *Cynips malphighii* (Cynipidae) (now = *Neuroterus quercusbaccarum*). Mayr (1874) and Milliron (1949) summarized the following list of cynipid hosts between them, many of which have been repeated in prior and subsequent literature [in the following list, the currently correct valid name is given first with the original name in parentheses]: *Andricus* (as *Cynips*) *caputmedusae*, *A.* (as *Cynips*) *conglomeratus*, *A.* (as *Cynips*) *coriarius*, *A.* *quercuscorticis* (as *corticis*), *A. curvator*, *A. cydoniae*, *A. fecundator* (as *Aphilothrix gemmae*), *A. gallaetinctoriae* (as *Cynips tinctoriae*), *A.* (as *Cynips*) *glutinosus* (as *glutinosa coronata*), *A. grossulariae*, *A. inflator* (as *globuli*), *A.* (as *Cynips*) *kollari*, *A.* (as *Cynips*) *korlevici*, *A.* (as *Cynips*) *lignicolus*, *A.* (as *Aphilothrix*) *lucidus*, *A.* *multiplicatus*, *A. paradoxus* (as *albopunctatus*), *A.* (as *Cynips*) *polycerus*, *A.* *quercusradicis* (as *noduli* and as *trilineatus*), *A.* *quercusramuli* (as *quercusramuli autumnalis*), *A. singulus* (as *singularis*), *A. viscosus* (as *Cynips mayri*), *Biorhiza pallida* (as *Andricus terminalis* and *Biorhiza terminalis*), *Callirhytis* (as *Andricus*) *glandium*, *Cynips divisa*, *C. longiventris*, *C. quercusfolii* (as *folii*), *Neuroterus macropterus* (as *Dryophanta macroptera*), *N. quercusbaccarum* (as *quercusbaccarum lenticularis*), *N. saliens* (as *Spathegaster glandiformis*), *Plagiotrochus quercusilicis* (as *kiefferianus*), *Synergus pallicornis* (as *flavicornis*), *S. reinhardi*, *S. umbraculus*, and *Synophrus politus*. Hoffmeyer (1931) reported *Andricus testaceipes*. Wall (1984) gave the additional hosts: *A. corruptrix* and *Aphelonyx cerricola*. In India it was reported from "cocoons on *Quercus semecarpifolia*" (Mani and Kaul 1972) and a cynipid gall on *Quercus spicata* (Kieffer 1905).

BIOLOGY.—This species is a parasitoid of Cynipidae on *Quercus*, including both gall-formers and their inquilines (Askew 1966, Bouček 1977). According to Fahringer (1922), eggs were laid in June. Several first instar larvae attached themselves to the spiracle of a cynipid larva. The larva of *dorsalis* overwintered in the gall chamber beside the consumed larval integument of the host and pupated in March of the next year. Askew (1966) stated that there were two generations per year with initial emergence in May and June. These adults attacked a different set of gall-formers from which progeny emerged in July and August. Askew (1966) considered this to be a case of host alternation. He also found evidence of *M. dorsalis* parasitizing inquiline cynipids living in the primary host gall. Parker (1924) illustrated the egg and larval stages of this species, and Askew (1966) illustrated the mature larva. According to Askew (1961) this species may act as a hyperparasite of *Torymus auratus*, *T. nigricornis* (now = *auratus*), and *T. cingulatus* attacking *Biorhiza pallida* and its inhabitants.

MORPHOLOGY.—Domenichini (1953) presented a short description of the abdominal morphology of this species. Copeland and King (1972) illustrated and discussed the internal structure of the reproductive system.

drances Walker. AUSTRALIAN: Australia (Tasmania).

Megastigmus drances Walker 1839:5. Lectotype female (desig. by Bouček 1988), Hobart Town, Van Diemen's Land, Tasmania (BMNH).

TAXONOMY—The description was repeated by Girault 1915/243:297-298.

duclouxiana (of authors). PALEARCTIC: People's Republic of China (Yunnan, Sichuan).

Megastigmus duclouxiana Roques and Pan 1995 (in Roques et al. 1995):214-215 (Figs. 1, 2, 9, 10). Holotype male, Anning Hot Springs, Anning County, Yunnan, PRC (NFU); 4 female, 4 male paratypes same data as holotype (NFU, INRA).

Megastigmus duclouxianae Xu and He 1995:249-250, 253 (Figs. 12-15). Holotype female, Chengdu, Sichuan, PRC (ZAU); 10 female, 11 male paratypes, same as holotype.

TAXONOMY.—There is confusion over which authors have priority for this name, but the correct authors will be formally recognized by Roques and Skrzypczynska (in prep.).

HOSTS.—The holotypes of both names were reared from seeds of *Cupressus duclouxiana*; paratypes of Roques and Pan (in Roques et al. 1995) were also reared from seeds of *torulosa*.

dumicola Bouček. PALEARCTIC: France.

Megastigmus dumicola Bouček 1982:183-184 (Figs. 1-2). Holotype female, Var, Ramatuelle, S. of St. Tropez, France (BMNH); 1 female paratype, same data as holotype; 1 female paratype, Pampelonne, S. of St. Tropez (BMNH).

HOST.—Associated with "marquis"-type vegetation.

eucalypti Girault. AUSTRALIAN: Australia (Victoria).

Megastigmus eucalypti Girault 1915/243:300-301. 3 syntype females, Melbourne, Victoria, Australia (QM, examined).

TAXONOMY.—Dahms (1983) discussed the types of this species.

HOST.—The syntypes were reared from unidentified galls on *Eucalyptus*.

ezomatsuanus Hussey and Kamijo. PALEARCTIC: Japan; People's Republic of China (Xinjiang [Xu and He 1995], Heilongjiang [Roques et al. 1995]).

Megastigmus ezomatsuanus Hussey and Kamijo 1958:115-117 (Figs. A-B). Holotype female, Toikambetsu, Teshio Pref., Hokkaido, Japan (HU); 35 females, 38 males same data as holotype; 3 male paratypes, Ashoro, Hokkaido, Japan (HU).

TAXONOMY.—Zerova and Seryogina (1994) redescribed and illustrated both sexes. The female was redescribed by Roques et al. (1995).

HOSTS.—The types were reared from seeds of *Picea glehnii* and *P. jezoensis* in Japan. Records from the People's Republic of China include seeds of *Picea obovata* (Xu and He 1995) and *P. koraiensis* (Roques et al. 1995).

fidus Nikol'skaya. PALEARCTIC: Kirgistan.

Megastigmus fidus Nikol'skaya 1966b:858. Holotype female, Kirgiz range, Kirgistan (ZI); many female and male paratypes from numerous localities in Kirgistan (ZI).

TAXONOMY.—Zerova and Seryogina (1994) redescribed and illustrated the habitus of both sexes.

HOSTS.—The holotype and many paratypes were reared from seeds of *Juniperus sibirica*. Other paratypes were reared from *Juniperus sabina*. Nikol'skaya (1966b) lists *Juniperus semiglobosa*, *J. turkestanica* (now = *pseudosabina*), and *J. seravschanica* as possible hosts.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the damaged cone.

fieldingi Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus fieldingi Girault 1915/243:301. 2 female syntypes, Gordonvale, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1984) discussed the types of this species.

HOST.—Girault listed only "miscellaneous galls" for the type series. According to Dahms (1984), the label data on associated specimens (non-types) stated from woody gall on *Eucalyptus tessellaris*. I have seen these specimens (7 females, 1 male), labeled in Girault's hand, and agree with their identity.

firmae Kamijo. PALEARCTIC: Japan.

Megastigmus firmae Kamijo 1962:30-31 (Figs. 3B,D). Holotype female, Tomioka, Fukushima Pref., Honshu, Japan (HU); 1 male, same data as holotype; 1 female, 2 male paratypes, Honshu, Japan; 1 female, 1 male, Sunoura, Miyazaki Pref., Kyushu, Japan (HU).

TAXONOMY.—Zerova and Seryogina (1994) redescribed both sexes and illustrated the female.

HOST.—The holotype was reared from seeds of *Abies firma*.

flavivariegatus Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus flavivariegatus Girault 1915/243:300. Holotype female, Gordonvale (Cairns), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1984) discussed the type of this species.

floridanus Milliron. NEARCTIC: United States (Florida; Maryland [Grissell 1989a]).

Megastigmus floridanus Milliron 1949:342-343 (Fig. 15). Holotype female, Osceola, Florida, USA (USNM, examined).

HOSTS.—Phytophagous in seeds of *Ilex opaca* and *Ilex x attenuata* (Grissell 1989a, b).

BIOLOGY.—In northern areas, this species has one generation per year with the adults emerging in May and June and larval development beginning in early July (Grissell 1989a, b). These larvae mature in late August, overwinter in this state, and pupate in late spring of the following year. In Florida it was possible that several generations per year occurred, as the phenology of holly flowers and fruits was less synchronized than in the north.

formosus Milliron. NEARCTIC: Canada (Ontario, Quebec).

Megastigmus formosus Milliron 1949:339-341 (Fig. 23). Holotype female, Ottawa, Ontario, Canada (CNC); 4 female paratypes same data as holotype; 1 female paratype, Britannia, Ottawa, Ontario, Canada; 1 female paratype, Ste. Anne's, Quebec, Canada (CNC, USNM [examined], UM).

HOST.—Milliron (1949), in a footnote, stated that the possible hosts of this species were seeds of *Crataegus* or *Rosa*.

fulvipes (Girault). AUSTRALIAN: Australia (Queensland).

Xanthosomoides fulvipes Girault 1913/148:222. Holotype female, Brisbane, Queensland, Australia (QM, examined).

TAXONOMY.—The species WAS transferred to *Megastigmus* (*Epimegastigmus*) by Girault 1915/243:307. Dahms (1984) discussed the type of this species.

fuscicornis Girault. AUSTRALIAN: Australia (Tasmania).

Megastigmus fuscicornis Girault 1913/175:81. Holotype female, Burnie, Tasmania, Australia (SAM).

TAXONOMY.—The description was repeated by Girault 1915/243:300. Dahms (1984) discussed the type of this species.

gahani Milliron. NEARCTIC: United States (Colorado, Minnesota, Missouri).

Megastigmus physocarpi Crosby 1913:158 (in part).

Megastigmus gahani Milliron 1949:275-277. (Fig. 9). Holotype female, Houston County, Minnesota, USA (UM). Several hundred paratype females and males same data as holotype and St. Paul, Minnesota, USA (UM, USNM [examined], CU).

HOST.—The type and all paratypes were reared from seeds of *Physocarpus opulifolius intermedius*. Other specimens were reared from a cultivated form of *Physocarpus o. intermedius* "appearing to be *luteus*" (this name could not be confirmed).

BIOLOGY.—Milliron (1949) described the mating behaviour.

gravis Nikol'skaya. PALEARCTIC: Georgia.

Megastigmus gravis Nikol'skaya 1966b:858. Holotype female, from vicinity of "Tbilish, Karsani and Fzechvi" (type locality not specified), along with 82 female, 53 male paratypes (ZL).

TAXONOMY.—Zerova and Seryogina (1994) redescribed and illustrated the habitus for both sexes.

HOSTS.—The types were reared from seeds of *Juniperus foetidissima*. *Juniperus excelsa* was reported by Zerova and Seryogina (1994).

BIOLOGY.—Zerova and Seryogina (1994) illustrated the damaged cones.

grotiisi Girault. AUSTRALIAN: Australia (Northern Territory).

Megastigmus (Epimegastigmus) grotiisi Girault 1915/243:307. Holotype female, Port Darwin, Northern Territory (QM, examined).

TAXONOMY.—According to the original description, Girault described the female and male but treated only the female as a "type." Dahms (1984) could find no male specimens, and considered the only female a holotype.

HOST.—Although no host was given with the original description, Dahms (1984) stated that Girault's manuscript listed the host as a "gall on Currajong [= Kurrajong]", which is *Brachychiton populneum*.

habui Kamijo. PALEARCTIC: Japan.

Megastigmus habui Kamijo 1962:20-22 (Fig. 1A,D,F,G, 2). Holotype female, Urawa, Saitama Pref., Honshu, Japan (HU); 9 female, 10 male paratypes same data as holotype; 4 female, 5 male paratypes, Tokyo, Japan; 1 female, 7 male paratypes, Osaka, Japan (HU, National Institute of Agricultural Sciences).

HOST.—The types were reared from *Trichagalma serratae*.

herndoni Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus herndoni Girault 1935/445:2. Female syntypes, Forest Hill, Queensland, Australia (QM, examined).

TAXONOMY.—The species was redescribed by Girault (1940/460). Dahms (1984) discussed the syntypes.

HOST.—The original description stated simply "from bud galls", but according to Dahms (1984), in an unpublished manuscript by Girault the host is stated as being "reared from *Eucalyptus melanophloeia*." Although the host is most likely a bud gall-forming insect on *Eucalyptus*, it is possible that *herdoni* caused the galls.

hilaris Girault. AUSTRALIAN: Australia (South Australia).

Megastigmus hilaris Girault 1929/431:339. Holotype female, Lucindale, South Australia (SAM).

TAXONOMY.—Dahms (1984) discussed the type of this species.

hilli Dodd. AUSTRALIAN: Australia (Northern Territory).

Megastigmus hilli Dodd 1917:361. 1 female, 3 male syntypes, Darwin, Northern Territory, Australia ("QM").

TAXONOMY.—The syntypes were not in the Queensland Museum when I examined the collection in 1999. It is possible that they are at the South Australian Museum.

HOST.—The syntypes were reared from unspecified galls on *Eucalyptus miniatus*.

hoffmeyeri Walley. NEARCTIC: United States (Washington, Connecticut, New York [Milliron 1949]); Canada (Ontario, Quebec [Milliron 1949]).

Megastigmus spermotrophus canadensis Hoffmeyer 1930:218. 7 female, 2 male syntypes, "Canada"; 3 female syntypes, "Washington" (no depository stated, but probably Hoffmeyer Collection).

Megastigmus spermotrophus hoffmeyeri Walley 1932:188. New replacement name for *Megastigmus spermotrophus canadensis*, preoccupied by *Megastigma* (now = *Pteromalus*) *canadensis* Ashmead 1887 [Pteromalidae].

TAXONOMY.—This species was redescribed by Milliron (1949) who illustrated the forewing stigma and elevated *hoffmeyeri* to species rank.

HOSTS.—The syntypes were reared from seeds of *Tsuga canadensis* (Canada) and *Abies amabilis* (Washington), but Milliron (1949) discounted the latter record.

hypogea (Hussey). AFROTROPICAL: Kenya.

Eumegastigmus hypogea Hussey 1956a:158-159 (Figs. 1a,b, 2). Holotype female, Nairobi, Kenya (BMNH); 3 female, 4 male paratypes, same data as holotype (BMNH, Hussey Collection).

TAXONOMY.—Bouček (1978:129) transferred the species.

HOST.—The types were reared from "oil seed", which Hussey (1956a) suggested was from *Helianthus*. If this record is correct it is the only known example of a seed feeding megastigmine from the family Asteraceae. I have seen at least one species of *Megastigmus* (in the collection of the Department of Primary Industries, Brisbane, Australia) that was reared from puparia of a tephritid in the seed head of an aster. It is likely that *M. hypogea* is parasitic on an insect rather than seeds.

iamenus Walker. AUSTRALIAN: Australia (Tasmania, New South Wales [Froggatt 1905]).

Megastigmus iamenus Walker 1839:6. Lectotype female (desig. by Bouček 1988), Hobart Town, Van Diemen's Land, Tasmania (BMNH); paralectotype female, same data as lectotype.

TAXONOMY.—The description was repeated by Girault (1915/243).

HOSTS.—The type material was not reared. This species was reported from galls of

Brachyscelis (now = *Apiomorpha*) *pileata* (Eriococcidae) and globular galls on *Eucalyptus* sp. (Ashmead 1900). Froggatt (1907) reported it from galls of *Brachyscelis* (now = *Apiomorpha*) *strombylosa*.

immaculatus Ashmead. ORIENTAL: Philippine Islands (Luzon).

Megastigmus immaculatus Ashmead 1905:401. Holotype female, Manila, Luzon, Philippines (USNM, examined).

inamurae Yano. PALEARCTIC: Japan, Korea (Paik 1978).

Megastigmus inamurae Yano (in Yano and Koyama) 1918a:47 (also 1918b:373). Syntypes (number unknown), Japan (destroyed by fire according to Kamijo 1962:31).

TAXONOMY.—Kamijo (1962), in his treatment of the Japanese species was, unable to place this taxon. Hussey (1962) gave characters to distinguish it in a key, and provided an English translation (by Kamijo) of the original description.

HOSTS.—The types were reared from seeds of *Larix leptolepis* (now = *kaempferi*). *Larix gmelinii* was reported by Kamijo (1962).

juniperi Nikol'skaya. PALEARCTIC: Uzbekistan, Kazakhstan, Kirgistan (Nikol'skaya 1966b).

Megastigmus juniperi Nikol'skaya 1952:106 (Fig. 165). Female and male specimens described in key, "Uzbekistan and Kazakhstan mountains" (ZI).

TAXONOMY.—No information, other than in the key, was given for this species. Kapuscinski (1946, updated 1964) redescribed both sexes. Zerova and Seryogina (1994) redescribed and illustrated the habitus for both sexes.

HOSTS.—The original specimens were reared from seeds of "Zeravshan juniper" (= *Juniperus seravschanica*). Additional hosts include *Juniperus semiglobosa* and *J. turkestanica* (Kapuscinski 1946, updated 1964).

BIOLOGY.—Zerova and Seryogina (1994) illustrated the damaged cone.

koebelei Ashmead. PALEARCTIC: Japan.

Megastigmus koebelei Ashmead 1904:146. Holotype female, Atami, Honshu, Japan (reportedly USNM, but apparently lost).

TAXONOMY.—This species, described from a single female, was listed as unplaced by Kamijo (1962). According to Burks (in Kamijo 1962), the type was lost, and I have not been able to find it despite several searches. In the type register books of the USNM collection, a male specimen with the same data as given in the original description was registered as the type. This specimen does not fit the description at all (regardless of sex), and so could not be considered as the type or even a neotype. The original description (and male mentioned above) contain a Koebele rearing number (1558), but reference to the Koebele number file shows no card entry for this number.

laricis Marcovitch. NEARCTIC: United States (New York).

Megastigmus laricis Marcovitch 1914:435-436 (Figs. 1-7). Lectotype female [designated by Milliron 1949], Ithaca, New York (UM); 14 female, 12 male paralectotypes, same data as holotype (UM,CU).

TAXONOMY.—Marcovitch (1914) illustrated the egg and larva. The species was redescribed by Milliron (1949), who illustrated the forewing stigma, designated the lectotype, and discussed the history of the type specimens. Hussey (1962) discussed its characters.

HOST.—The types were reared from seeds of *Larix laricina*.

lasiocarpae Crosby. NEARCTIC: United States (Colorado, Washington [Milliron 1949]); Canada (British Columbia); PALEARCTIC (introduced): Peoples Republic of China (Xinjiang [Xu and He 1995]).

Megastigmus lasiocarpae Crosby 1913:163 (Fig. 6). 2 female, 1 male syntypes, Rye, Colorado, USA (CU); 1 male paratype, same data (CU).

TAXONOMY.—This species was redescribed by Milliron (1949) who illustrated the forewing stigma.

HOSTS.—The types were reared from seeds of *Abies lasiocarpa*. Milliron (1949) reported the species from *A. amabilis*. In the People's Republic of China it was reported from seeds of *Abies sibirica* (Xu and He 1995).

leeuweni Ferriere. ORIENTAL: Indonesia (Java).

Megastigmus leeuweni Ferriere 1929:144-145 (Figs. 1a,b). 5 female syntypes, Buitenzorg, Java, Indonesia (BMNH).

HOST.—The types were reared from fruit of *Milletia* (now = *Dalbergia*) *sericea*.

likiangensis Roques and Sun. PALEARCTIC: People's Republic of China (Yunnan).

Megastigmus likiangensis Roques and Sun 1995 (in Roques et al. 1995):220-221 (Figs. 7, 15). Holotype female, Yulongxueshan, Lijian, Yunnan, PRC (NFU). 1 female paratype same data as holotype (INRA).

HOST.—The holotype was reared from seeds of *Picea likiangensis*.

limoni (Girault). AUSTRALIAN: Australia (Queensland).

Epimegastigmus limoni Girault 1926/398:2. Female and male syntypes (according to Dahms 1984), Eidsvold, Queensland, Australia (QM, examined).

TAXONOMY.—The species was transferred to *Megastigmus* by Milliron (1949:351). Dahms (1984) discussed the syntypes, and he listed *limoni morleyi* Girault 1940 as a valid subspecies but it is a *nomen nudum*.

HOSTS.—The original description listed the syntypes of this species as reared from "native limes." Dahms (1984) listed the following as hosts based on information in Girault's unpublished manuscript: seeds of *Atalantia glauca*, gall on *Acacia aulacocarpa*, "aborted thrip [sic] gall on *Acacia pendula*."

longicauda Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus longicauda Girault 1913/175:81. Holotype female, Port Lincoln, South Australia, Australia (SAM).

TAXONOMY.—The description was repeated by Girault 1915/243:300. Dahms (1984) discussed the type of this species.

maculatipennis (Girault). AUSTRALIAN: Australia (New South Wales, Queensland, South Australia).

Xanthosomoides maculatipennis Girault 1913/148:221-222. 3 syntype females, Brisbane, Queensland, Australia (QM, examined).

TAXONOMY.—The species was transferred to *Megastigmus* and the description repeated by Girault (1915/243:299). Dahms (1984) discussed the type(s) of this species; although it was described from 3 specimens, Dahms (1984) assumed that a single remaining specimen was the "holotype."

HOST.—The original description stated that *M. maculatipennis* was reared from galls. Dahms (1984) stated that specimens from ANIC were labeled "Port Jackson figs."

maculipennis Yasumatsu and Kamijo. PALEARCTIC: Japan, Korea, People's Republic of China (Hopei [Murakami et al. 1980]).

Megastigmus maculipennis Yasumatsu 1955:101. [*Nomen nudum*]

Megastigmus maculipennis Yasumatsu and Kamijo 1979:101-102 (Fig. 4-5). Holotype female, Aburaya-ma, Fukuoka-shi, Kyushu, Japan (KU); 34 female, 19 male paratypes, numerous localities (KU).

HOSTS.—The holotype was reared from *Dryocosmus kuriphilus* (Cynipidae). Paratypes were reared from the same host as well as galls of *Andricus* sp. and *Neuroterus* sp. (Cynipidae).

BIOLOGY.—This species has at least two generations per year (Yasumatsu and Kamijo 1979) and emerge from galls from June to August in PRC (Maruakami et al. 1980).

mali Nikol'skaya. PALEARCTIC: Russia (East Siberia), Japan (Kamijo 1962).

Megastigmus mali Nikol'skaya 1952:106 (Figs. 185, 186). Female and male specimens described in key, "West Siberia" (ZI).

TAXONOMY.—No other information was provided other than that in the key. Zerova and Seryogina (1994) provided a habitus drawing of the female.

HOSTS.—The types were reared from seeds of *Malus baccata*. Kamijo (1962) gave the host *Pyrus* (now = *Malus*) *pallasiana*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the damaged seed.

mariannensis Fullaway. AUSTRALIAN: Guam.

Megastigmus mariannensis Fullaway 1946:204. Holotype female, Yigo, Guam (USNM, examined); 1 female, 1 male paratype, Tarague, Guam (USNM [examined], BPBM); 1 female, 1 male paratype, Barrigada, Guam (BPBM).

HOST.—The holotype was reared from a "small fig." The paratypes from Tarague were reared from a "larger fig," and the paratypes from Barrigada were reared from *Ficus mariannensis* (presumably from the fruit, but not stated as such).

melanus Milliron. NEARCTIC: United States (?Michigan).

Megastigmus melanus Milliron 1949:302-303 (Fig. 24). Holotype female, "Ag. Coll. Mich.", USA (USNM, examined).

melleus Girault. AUSTRALIAN: Australia (Queensland)

Megastigmus melleus Girault 1915/243:301. Holotype female, Gordonvale (Cairns), Queensland, Australia (QM, examined).

TAXONOMY.—The species was transferred to *Neomegastigmus* by Riek (1966) but returned to *Megastigmus* by Bouček (1988). Dahms (1984) discussed the type.

HOST.—The species was recorded from bud galls on *Hakea* (Riek 1966), but I have examined specimens placed by Riek as *melleus* and do not believe they are this species. Therefore, I consider the host record to be doubtful.

mercatori (Girault). AUSTRALIAN: Australia (New South Wales).

Epimegastigmus mercatori Girault 1940/460:106. Syntypes, no locality was given but Dahms (1984:808) listed Killara, nr. Sydney, New South Wales, Australia (from Girault's unpublished manuscript) (ANIC, examined in part).

TAXONOMY.—Dahms (1984) discussed the syntypes of this species. It was transferred by Bouček (1988).

HOST.—The syntypes were reared from galls on "A. [Acacia] implexa."

milleri Milliron. NEARCTIC: United States (California); Canada (British Columbia). PALEARCTIC: Introduced and probably widespread in Europe (Roques and Skrzypczynska in prep.).

Megastigmus pinus Parfitt of Crosby 1913:162, 168 (in part according to Milliron 1949).

Megastigmus milleri Milliron 1949:323-326 (Fig. 26). Holotype female, Crescent City, California, USA (USNM, examined). 39 female, 22 male paratype same data as holotype (USNM, UM).

TAXONOMY.—Hussey and Klingler (1954) illustrated the thorax and propodeum and concluded that *milleri* was distinct from *pinus*. Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male of this species.

HOSTS.—The type and paratypes were reared from seeds of *Abies grandis* and *A. magnifica shastensis*. In Europe this species is found in the seeds of introduced *Abies grandis* and *A. magnifica*, as well as the native *A. alba* (Roques and Skrzypczynska in prep.).

BIOLOGY.—Keen (1958) provided a few notes on the emergence of this species. The sex ratio is balanced (Roques and Skrzypczynska in prep.).

nigripropodeum Girault. AUSTRALIAN: Australia (West Australia).

Megastigmus nigripropodeum Girault 1934/443:2. 2 female, 1 male syntypes, Perth, West Australia, Australia (WADA).

TAXONOMY.—Dahms (1986) discussed the syntypes of this species.

nigrovariegatus Ashmead. NEARCTIC: United States (coast to coast, and from Utah (southernmost) to Alaska (northernmost) [Milliron 1949]); Canada (British Columbia, Vancouver Island, Nova Scotia, Quebec [Milliron 1949]). PALEARCTIC (introduced, Roques and Skrzypczynska in prep.): France.

Megastigmus nigrovariegatus Ashmead 1890:26. Lectotype female (desig. by Milliron 1949:297), Greeley Colorado, USA (USNM, examined); 5 female paralectotypes, Vancouver Island, British Columbia, Canada (USNM).

Megastigmus nigovarietus Laidlaw 1931:191 (Lapsus).

TAXONOMY.—Crosby (1913) redescribed the female, was the first to describe the male, and illustrated the forewing stigma of both sexes. The species was redescribed by Milliron (1949), who illustrated the forewing stigma and designated a lectotype. Balduf (1959) illustrated the adult female and discussed variation in this species (1957). Roques and Skrzypczynska (in prep.) redescribed and illustrated both sexes.

HOSTS.—The types were not reared. All known hosts are seeds of *Rosa* and were summarized for the Nearctic by Peck (1963) and Roques and Skrzypczynska (in prep.): *Rosa acicularis*, *R. arkansana*, *R. blanda*, *R. californica*, *R. canina*, *R. carolina*, *R. engelmannii*, *R. eglanteria* (now = *rubiginosa*), *R. lunelli*, *R. macounii* (now = *woodsii*), *R. palustris*, *R. pyrifera*, *R. rubiginosa*, *R. rugosa*, *R. setigera*, *R. spaldingi* (now = *nutkana hispida*), *R. spinosissima* (now = *pimpinellifolia*), *R. suffulta*, *R. ultramontana* (now = *woodsii ultramontana*), *R. virginiana*, *R. woodsii*, and *R. xanthina*. *Rosa pendulina* was reported in France (Roques and Skrzypczynska in prep.).

BIOLOGY.—Milliron (1949) studied this species in great detail and illustrated the egg, larval, and pupal stages. In Minnesota oviposition occurred from early June to mid-July. One to three eggs were laid in tissue surrounding the seed embryo; they hatched in less than 5 days. Because of cannibalism, only one larva survived to maturity in each seed. There are 5 larval instars, all of which were described. In Minnesota there was one generation per year, but developmental time could be shortened by six months

by altering temperature cycles. Adults lived from 1 to 15 days under natural conditions (shorter under laboratory conditions). Sex ratio is nearly even. Balduf (1945, 1959), who also studied this species, presented much the same information as Milliron (1949).

PARASITES.—Balduf (1959) stated that *M. aculeatus* was attacked by a species of *Eupelmus*.

nipponicus Yasumatsu and Kamijo. PALEARCTIC: Japan, People's Republic of China (Hopei [Murakami et al. 1980].

Megastigmus japonicus Yasumatsu 1955:100. [*Nomen nudum*]

Megastigmus nipponicus Yasumatsu and Kamijo 1979:98-101 (Figs. 2, 3). Holotype female, Ina, Naganoken, Japan (KU); many female and male paratypes from numerous localities (KU).

HOSTS.—The holotype was reared from *Dryocosmus kuriphilus* (Cynipidae); paratypes were reared from the same host as well as *Andricus* spp. and *Biorhiza weldi* (Cynipidae).

BIOLOGY.—This species has two generations per year and overwinters as a mature larva (Yasumatsu and Kamijo 1979).

pallidiocellus Girault. AUSTRALIAN: Australia (South Australia).

Megastigmus pallidiocellus Girault 1929/431:339-340. Holotype female, Banyo, Queensland, South Australia, Australia (QM, examined); 1 female paratype, Adelaide, South Australia, Australia (SAM); 1 female paratype, Ooldea, South Australia, Australia (SAM).

TAXONOMY.—Dahms (1986) discussed the types of this species.

pascali (Girault) AUSTRALIAN: Australia (Queensland).

Epimegastigmus pascali Girault 1933/440:3. Holotype female, Forest, Wynnum, Queensland, Australia (QM, examined).

TAXONOMY.—The species was transferred to *Megastigmus* by Milliron (1949). Dahms (1986) discussed the type.

pergracilis Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus pergracilis Girault 1915/243:301-302. Holotype female, Capeville, Queensland, Australia (lost).

TAXONOMY.—The type of this species is lost according to Dahms (1986).

physocarpi Crosby. NEARCTIC: United States (Missouri; Idaho, Indiana, Michigan, Minnesota [Milliron 1949]); Canada (Ontario, Quebec [Milliron 1949]).

Megastigmus physocarpi Crosby 1913:158 (Fig. 2). Lectotype female (designated by Milliron 1949), Allentown [?Allenton], Missouri, USA (USNM, examined). 4 female, 6 male paralectotypes same data; 1 male paralectotype, Kirkwood, Missouri, USA (USNM, CU).

TAXONOMY.—This species was redescribed by Milliron (1949) who illustrated the forewing stigma.

HOSTS.—The lectotype series was reared from seeds of *Physocarpus opulifolius* and *Physocarpus o. intermedium*. Milliron (1949) stated that hosts of the Idaho specimen might be either *Physocarpus malvaceus* or *P. monogynus*.

BIOLOGY.—Milliron (1949) described the mating behavior and compared it to *Megastigmus gahani*.

pictus (Förster). PALEARCTIC: Widespread from Great Britain to northeastern People's Republic of China (Roques and Skrzypczynska in prep.).

Torymus pictus Förster 1840:31. Lectotype female (see Bouček 1970b:268), Germany (NMW).

Megastigmus seitneri Hoffmeyer 1929:327 (Figs. 8, 9). Holotype female, Lellinge Wald, Denmark (ZMUC, according to Hussey 1962, Bouček 1970b); 7 female paratypes, same data as holotype (ZMUC). [Synonymized by Bouček 1970b.]

TAXONOMY.—Hoffmeyer (1930) illustrated the female stigmal vein. Escherich (1938) illustrated the adult female. Hussey (1962) redescribed the female and described the male for the first time, and illustrated both sexes. He stated that a "neotype male" was in his own collection, but this has no validity. Bouček (1971) illustrated the forewing and head and discussed this species with respect to *M. rosae* with which it had been confused. Zerova and Seryogina (1994) redescribed both sexes and illustrated the female (habitus). Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male of this species.

HOSTS.—The types of *seitneri* were reared from seeds of *Larix decidua*. The species has been reared from seeds of the following indigenous trees: *Larix decidua polonica*, *L. dahurica* (now = *gmelinii gmelinii*), *L. sibirica*, and *L. sukaczewii* (Roques and Skrzypczynska in prep.). It is also reared from the following non-indigenous trees: *L. leptolepis* (now = *kaempferi*), *L. x czekanowski*, and *L. x eurolepis* (Roques and Skrzypczynska in prep.). Xu and He (1995) reported *L. olgensis koreana* (now = *L. gmelinii olgensis*) and *L. principisrupprechtii* (now = *gmelinii principisrupprechtii*).

BIOLOGY.—Zhang and Zhou (1990) reported that there was one generation every two years, and that larvae diapaused for one to two years. Zerova and Seryogina (1994) illustrated seed and cone damage caused by this species. Males are uncommon (less than 1% of the population) (Skrzypczynska 1981).

PARASITES.—This species is parasitized by *Mesopolobus zetterstedtii* (Dalle Torre) (Pteromalidae) and *Eupelmus urozonus* Dalman (Eupelmidae) (Skrzypczynska 1973).

pingii Roques and Sun. PALEARCTIC: People's Republic of China (Yunnan).

Megastigmus pingii Roques and Sun 1995 (in Roques et al. 1995):217 (Figs. 3, 4, 11, 12).

Holotype male, Yulongxueshan, Lijiang, Yunnan, PRC (NFU). 2 female, 1 male paratypes same data as holotype (NFU, INRA).

HOST.—The holotype was reared from seeds of *Juniperus pingii*.

pinsapinis Hoffmeyer. PALEARCTIC: Originated in North Africa and/or Spain; present range covers the major part of the western Mediterranean basin (Roques and Skrzypczynska in prep.).

Megastigmus suspectus pinsapinis Hoffmeyer 1931:264. Female, described in key.

TAXONOMY.—Hussey (1957) redescribed the female and illustrated its scutellum. Pintureau et al. (1991) elevated *pinsapinis* to species rank based on electrophoretic results, redescribed it, and illustrated the male genitalia and antenna. They reviewed and illustrated the distribution of *suspectus suspectus* and *suspectus pinsapinis*. Pintureau et al. (1991) were the first to describe and illustrate the male of this species. Roques and Skrzypczynska (in prep.) redescribed and illustrated the female. They also reviewed the extensive literature on this species.

HOSTS.—The type(s) was reared from seeds of *Abies pinsapo*. Roques and Skrzypczynska (in prep.) summarized hosts in the natural range of the following tree species: *Cedrus*

atlantica, *Abies pinsapo*, and *A. alba*. They reported the following exotic tree species attacked in French arboreta: *Cedrus brevifolia*, *C. deodara*, *C. libani*, and *Abies nordmanniana*.

BIOLOGY.—The species reproduces by thelytokous parthenogenesis (Pintereau et al. 1991).

Males have a ratio of about 1 to 4000 females (Fabre et al. 1994).

ECONOMIC IMPORTANCE.—The species extensively colonized plantations of *Cedrus atlantica* and *Abies pinsapo* in France (Fabre 1986).

pinus Parfitt. NEARCTIC: United States (California, Oregon, Washington, Idaho, Nevada, Colorado); Canada (British Columbia [Keen 1958]). PALEARCTIC (introduced): Throughout most of Western Europe (Roques and Skrzypczynska in prep.).

Megastigmus pinus Parfitt 1857a:5543-5544 (and 5629-5630, corrections to description given on previous pages). Holotype female, California, USA (BMNH).

Megastigmus pinus crosbyi Hoffmeyer 1930:215. Holotype female, Colorado, USA (Hoffmeyer Collection); 1 female paratype, Washington (Hoffmeyer Collection). [Synonymized by Milliron 1949:318.]

TAXONOMY.—Parfitt (1857b) described what he thought to be the male of this species, which subsequently turned out to be *M. rafni*. Crosby (1913) and Milliron (1949) both redescribed and illustrated the forewing stigmas of females and males. Escherich (1938) illustrated the adult female. Milliron (1949) discussed the variation found in this species, stating that specimens reared from *Abies magnifica* were larger, had coarser sculpture, and an ovipositor longer than the body whereas specimens reared from *Abies lasiocarpa* and *A. grandis* were smaller, more weakly sculptured, and had the ovipositor shorter than the body. Specimens reared from *A. procera* and *A. concolor* were intermediate. Hussey and Klingler (1954) gave an exemplary and detailed account of morphological variation within this species. They illustrated thoracic color pattern and propodeal variation within *M. pinus*, demonstrating that larger specimens are generally lighter in color, have a greater number of sub-marginal bristles, have coarser surface sculpturing, and show a reduction in the median propodeal carina. They also stated that populations reared from the same host tree could have different color patterns in different years. Zerova and Seryogina (1994) redescribed both sexes and illustrated the female. Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male.

HOSTS.—The original host given for this species was “found amongst the seeds of” *Picea* (= *Abies*) *bracteata* (see discussion in Keen 1958), *Thuja*, and *Pinus* (= *Abies*) *nobilis*. Parfitt (1857a) thought the wasp was attacking “cynipids” associated with these hosts, but this was in error. The original host given for *pinus crosbyi* was *Abies concolor*. The following Nearctic hosts were summarized by Roques and Skrzypczynska (in prep.): *Abies amabilis*, *A. grandis*, *A. lasiocarpa*, *A. magnifica*, *A. procera*, and *A. shastensis*. *Abies venusta* (now = *bracteata*) (Keen 1958) was not cited by Roques and Skrzypczynska (in prep.). In Europe, the species is reported from several of the above trees (*A. concolor*, *A. grandis*, *A. procera*) and it has also shifted to Mediterranean firs introduced into France, namely *Abies cilicica*, *A. bornmuelleriana* (now = *nordmanniana equitrojani*), *A. numidica*, and *A. pinsapo* (see Roques and Skrzypczynska in prep.). Milliron (1949) dismissed reports on *Picea sitchensis* and *Thuja plicata*, and Roques and Skrzypczynska (in prep.) dismissed records of *Pinus*.

BIOLOGY.—Laidlaw (1931) presented information on this species in Scotland. Emergence from seed was in May and June. Females inserted their ovipositor through cone scales.

Larvae were mature by September, overwinter and pupate in April and May. The larval and pupal stages were illustrated. Escherich (1938) illustrated the damage to seed caused by this species. Keen (1958) reviewed the biology of this species and illustrated seed damage and the larva. Keen (1958) observed oviposition of this species, and demonstrated that the female oviposited directly into the seed through several cone scales. In Oregon, small larvae were dissected from seed in July and were mature by September at which point they overwintered. Pupation occurred the following March and April, and adults emerged in April and May. Twenty-five to fifty percent of wasps emerged in the second or third year. According to Hussey and Klingler (1954), large males within a population were "not usually successful in mating with small females." Zerova and Seryogina (1994) illustrated damaged seed. The sex ratio is balanced (reviewed by Roques and Skrzypczynska in prep.). Scurlock et al. (1982) stated that this species could develop in fertilized or unfertilized seed.

ECONOMIC IMPORTANCE.—According to Scurlock et al. (1982), of nearly 15,000 seeds of *Abies procera* examined, 99.3% were unsound with 36% damaged by insects and 63.3% unpollinated. *Megastigmus pinus* was among the top 3 insect species causing damage.

pinus marginatus Hoffmeyer. NEARCTIC: United States (Oregon).

Megastigmus pinus marginatus Hoffmeyer 1930:215. Holotype male, Oregon, USA (Hoffmeyer Collection).

TAXONOMY.—This species was discussed by Milliron (1949) who placed it as an unrecognized species. Hussey and Klingler (1954) stated that this is probably not a valid "variety."

HOST.—The type was reared from seeds of *Abies grandis*.

pistaciae Walker. PALEARCTIC: France, Italy, coastal Mediterranean areas (Bouček 1977) to Iran (Roques and Skrzypczynska in prep.), and Crimea, Transcaucasia, and Turkmenia (Bouček 1977). NEARCTIC (introduced): United States (California [Robinson 1968]).

Megastigmus pistaciae Haliday, Walker 1869:313. [*Nomen nudum*]

Megastigmus pistaciae Walker 1871:35. Syntype females, "S. France" and Tuscany (BMNH).

Trogocarpus ballestreri Rondani 1877:204-205 (Figs. 109-114). Lectotype female (designated by Bouček 1974:245), Italy (La Specola, Florence). [Synonymized by Masi 1934:210.]

TAXONOMY.—Walker (1869, 1871) attributed the species name to Haliday, but Walker was the first to describe it. Bouček (1974) discussed the types of Rondani and the question of synonymy, which might be attributed either to Masi (1934) by implication or directly to Nikol'skaya (1935:83). Nikol'skaya (1935) redescribed and illustrated the female as did Zerova and Seryogina (1994) and Roques and Skrzypczynska (in prep.). The most recent literature on this species as an introduction into the New World was given by Rice and Michailides (1988), and Roques and Skrzypczynska (in prep.) summarized the Old World literature.

HOSTS.—Walker's types were taken "... on *Pistacia lentiscus* and on *P. terebinthus*." The syntypes (of *ballestreri*) were reared from seeds of *Pistacia vera*. De Stefani (1917) also reported *Pistacia vera* as a host but suggested that the "natural" host was *terebinthus*. Nikol'skaya (1935) listed *P. mutica* and Davatchi (1958) listed *P. atlantica* as hosts. In its introduced range (California), *M. pistaciae* was reported to attack the following hosts (all introduced): *P. chinensis*, *P. integerrima*, *P. atlantica*, *P. lentiscus*, *P. vera*

'Kerman' (commercial cultivar), and a hybrid between *P. atlantica* and *P. vera* (Rice and Michailides 1988). It was reported on *Schinus terebinthifolius* in Israel (Furth 1985).

BIOLOGY.—The biology of this species (as *ballestreri*) was discussed by De Stefani (1908, 1917). In Italy, eggs were deposited in June and July. Larvae were mature by September and overwintered until May when they pupated and emerged. Generally there was only a single generation per year, but occasionally a few of the larvae pupated in August and September. At this time most of the host seeds were too hard for oviposition, but a few soft young fruits could be found and two generations per year occurred. Similar findings were made by Anagnostopoulos (1938) in Greece (as *ballestreri*), Tunisia (Jarraya and Bernard 1971), and California (Rice and Michailides 1988). Zerova and Seryogina (1994) illustrated the damaged seed. Roques and Skrzypczynska (in prep.) stated that males were extremely rare. Rice and Michailides (1988) found that males were about 4% of the population.

ECONOMIC IMPORTANCE.—According to Vasil'eva (1991) this wasp infested up to 100% of *Pistacia mutica* and 70% of *P. vera*.

PARASITES.—Two eurytomids, *Sycophia biguttata* (Swederus) and *Eurytoma rosae* Nees, have been reported as parasites of *M. pistaciae* (Davatchi 1958).

***pourthiaeae* Kamijo. PALEARCTIC: Japan.**

Megastigmus pourthiaeae Kamijo 1962:26-27 (Figs. 1D, 3A). Holotype female, Yamabe, Hokkaido, Japan (HU); 39 female, 70 male paratypes, same data as holotype; 1 male paratype, Amagisan, Shizuoka Pref., Honshu, Japan (HU).

TAXONOMY.—Zerova and Seryogina (1994) redescribed both sexes and illustrated female.

HOST.—The types were reared from seeds of *Pourthiaeae villosa*.

***pseudomali* Xu and He. PALEARCTIC: People's Republic of China (Guizhou).**

Megastigmus pseudomali Xu and He 1995:247-248, 253 (Figs. 5-8). Holotype female, Dushan, Guizhou, People's Republic of China (ZAU); 3 female, 3 male paratypes same data as holotype (ZAU).

HOST.—The types were reared from seeds of a conifer.

***pseudotsugaphilus* Xu and He. PALEARCTIC: People's Republic of China (Zhejiang).**

Megastigmus pseudotsugaphilus Xu and He 1995:245-246, 252 (Figs. 1-4). Holotype female, Western Tianmu Shan, Zhejiang, People's Republic of China (ZAU); 1 female, 2 male paratypes, same data as holotype (ZAU); 1 female, 1 male paratype, Anhui, Huangshan, Zhejiang (ZAU).

HOST.—The types were reared from seeds of *Pseudotsuga gaussenii*.

***quadrifasciativentris* Girault. AUSTRALIAN: Australia (Queensland).**

Megastigmus quadrifasciativentris Girault 1915/243:302. Holotype female, Capeville, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species.

***quadrisetae* Girault. AUSTRALIAN: Australia (Tasmania).**

Megastigmus quadrisetae Girault 1927/416:330-331. Holotype female, Cradle Mountain, Tasmania, Australia (SAM).

TAXONOMY.—Dahms (1986) discussed the type of this species.

quinquefasciatus Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus (Epimegastigmus) quinquefasciatus Girault 1915/243:308. Holotype female, Gordonvale (Cairns), Queensland, Australia (lost, according to Dahms 1986).

TAXONOMY.—Dahms (1986) discussed the type of this species.

quinquesetae (Girault). AUSTRALIAN: Australia (Federal Capital Territory).

Epimegastigmus quinquesetae Girault 1934/444:3. Holotype female, Black Mt., Federal Capital Territory, Australia (ANIC, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species and Milliron (1949) transferred it to *Megastigmus*.

HOST.—The type was reared from flower galls on *Eucalyptus macrorhyncha* (= *macrorhyncha*). According to Currie (1937), *quinquesetae* is a competitor of *Fergusonina* flies (Cecidomyiidae) in these galls.

rafni Hoffmeyer. NEARCTIC: United States (California, Oregon, Washington, Idaho, Colorado, and New Mexico [Milliron 1949]; Arizona [Keen 1958]). Canada (British Columbia [Keen 1958]). PALEARCTIC (introduced): Western Europe (Roques and Skrzypczynska in prep.).

Megastigmus pinus Parfitt 1857b:5721 (subsequent description of male, *nec* female 1857a).

Megastigmus spermotrophus of Crosby 1913:163 (Fig. 7) and authors (misidentification in part).

Megastigmus rafni Hoffmeyer 1929:331-332 (Fig. 13). Holotype female, "Central" USA (Hoffmeyer Collection); 11 female paratypes, same data as holotype (ZMUC, USNM [examined]).

TAXONOMY.—Parfitt (1857b) described the male of what he thought to be *M. pinus* in a paper published after the description of the female (1857a). Milliron (1949) was the first to recognize that the male of *M. pinus* Parfitt (1857b) belonged to the species *M. rafni*. After Hoffmeyer (1929) described the female, he described and illustrated the male (Hoffmeyer 1930). This species was redescribed by Milliron (1949) who illustrated the forewing stigma and discussed the problems of misidentifications relative to *pinus* and *spermotrophus*. Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male of this species.

HOSTS.—The type material of *rafni* was reared from seeds of *Abies concolor* and *Pseudotsuga douglasii* (now = *menziesii*), but Hoffmeyer later (1930:217) dropped the latter name from his list of hosts. Milliron (1949) reported this species from seeds of *Abies concolor*, *A. grandis*, *A. magnifica*, and *A. shastensis*. This list has not been more recently updated. Roques and Skrzypczynska (in prep.) reported the following hosts in Europe (all considered host-shifts): *Abies bornmuelleriana* (now = *nordmanniana equitrojani*), *A. cephalonica*, *A. cilicica*, *A. marocana* (now = *pinsapo marocana*), *A. nordmanniana*, *A. numidica*, and *A. pinsapo*. In Europe, *Megastigmus rafni* attacks the following hosts introduced from the Nearctic: *A. concolor*, *A. grandis*, and *A. procera* (Roques and Skrzypczynska in prep.).

DISTRIBUTION.—Hoffmeyer (1930:217) listed Colorado and California as the collection sites for this species. The original description (1929) simply listed "Central States".

BIOLOGY.—Keen (1958) briefly discussed the seasonal history of this species and illustrated the larvae in seeds of white fir. Adults emerged from late April to July and September in some localities. Emergence could occur in the second or third year after oviposition. Roques and Skrzypczynska (in prep.) reported that the sex ratio was balanced.

ECONOMIC IMPORTANCE.—According to Keen (1958) this species in combination with *M. pinus* destroyed up to 60 percent of seed in some years.

rhusi (Hussey). AFROTROPICAL: South Africa (Free State).

Eumegastigmus rhusi Hussey 1956a:161 (Figs. 1e,f, 3). Holotype female, Bloemfontein, Orange Free State, South Africa (BMNH); 2 female, 4 male paratypes, same data as holotype (BMNH, Hussey Collection).

TAXONOMY.—Bouček (1978:129) transferred the species.

HOST.—The types were reared from seeds of *Rhus lancea*.

rosae Bouček. PALEARCTIC: Southern Alps to central Europe, Caucasus, and Siberia (Roques and Skrzypczynska in prep.).

Megastigmus pictus of Wachtl (1884b:214). [According to Bouček 1970b]

Megastigmus pictus of Hoffmeyer (1931:265). [According to Bouček 1970b]

Megastigmus rosae Bouček 1971:43-44 (Figs. 1-3). Holotype female, Wien, Austria (BMNH); 1 paratype female, same data as holotype (NMP); 31 female, 1 male paratypes, Znojmo, Moravia, Czechoslovakia (IFHB).

TAXONOMY.—Zerova and Seryogina (1994) provided habitus drawings of both sexes of this species. Roques and Skrzypczynska (in prep.) redescribed and illustrated the female.

HOSTS.—The types were reared from seeds of unknown *Rosa* spp. Zerova and Seryogina (1994) reported this species from seeds of *Rosa canina*, *R. turkestanica*, and *R. tschatschyrdagii*. In addition, Roques and Skrzypczynska (in prep.) reported it from seeds of *Rosa arvensis*, *R. ferruginea*, *R. pendulina*, and *R. rubiginosa*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated seed damage caused by this species. The sex ratio was heavily skewed toward females (Bouček 1971, Zerova and Seryogina 1994).

rosae kondaricus Zerova and Seryogina. PALEARCTIC: Russia (Tadzhikistan), Bulgaria (Roques and Skrzypczynska in prep.).

Megastigmus rosae kondaricus Zerova and Seryogina 1994:48-49 (Pl. 4, Figs. 1-3). Holotype female, Pamir Altai mountains, Tadzhikistan, Russia (IZU); 19 female, 20 male paratypes, same data as holotype (IZU).

TAXONOMY.—In the original description all the type material is listed as male, but the description is for both females and males. I have listed the type material above as is most likely the correct count.

HOST.—The types were reared from seeds of *Rosa kokinica*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the seed damage caused by this species. The sex ratio is about 1:1 (Zerova and Seryogina 1994).

sabinae Xu and He. PALEARCTIC: People's Republic of China (Gansu Province, Qinhai Province).

Megastigmus sabinae Xu and He 1989:482 (Figs. 1-11). Holotype female, Zhangye, Gansu Province, People's Republic of China (ZAU); 56 female, 28 male paratypes same data as holotype; 55 female, 76 male paratypes, Ulan, Qinghai Province, PRC (ZAU).

TAXONOMY.—Zerova and Seryogina (1994) redescribed the female and male, and illustrated the female habitus.

HOSTS.—The types were all reared from seeds of *Sabina* (now = *Juniperus*) *przewalskii*. Wu et al. (1992) reported *Juniperus convalliflora* and *J. komarovii*. Xu and He (1995) reported *J. tibetica* and *J. saltuaria*.

BIOLOGY.—Wu et al. (1993) discussed the emergence of this species.

schimitscheki Novitzky. PALEARCTIC: "Southeastern Europe to Asia Minor" (Roques and Skrzypczynska in prep.).

Megastigmus schimitscheki Novitzky 1954:220-224 (Figs. 1-5). 10 female, 10 male syntypes, Alanya-Ayandere, Turkey (Novitsky Collection, Schimitschek Collection).

TAXONOMY.—Hussey (1957) redescribed the female and illustrated its scutellum (his figure B3, but mislabeled in legend as figure B4). Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male.

HOSTS.—The types were reared from seeds of *Cedrus libani*. Hussey (1957) reported *C. brevifolia* as a host.

BIOLOGY.—The sex ratio is basically 1:1 (Fabre et al. 1994).

schimitscheki libanoticus Novitzky. PALEARCTIC: Syria.

Megastigmus schimitscheki libanoticus Novitzky 1954:224 (Fig. 4). 1 female, 1 male syntypes, Libanon, Syrien (Novitsky Collection).

sexsetae Girault. AUSTRALIAN: Australia (Tasmania).

Megastigmus sexsetae Girault 1927/416:331. Holotype female, Tasmania, Launceston, Australia (SAM).

TAXONOMY.—Dahms (1986) discussed the type of this species.

sinensis Sheng. PALEARCTIC: People's Republic of China.

Megastigmus sinensis Sheng 1989:30 [reference not seen].

TAXONOMY.—In spite of extensive efforts to obtain the reference for this species, I have been unable to locate a copy of the original paper.

HOST.—The types were reportedly reared from bamboo shoots, and if this is correct, it is most likely that the true host is an insect in the shoots.

somaliensis Hussey. AFROTROPICAL: Somalia, Ethiopia.

Megastigmus somaliensis Hussey 1956b:57-57 (Figs. 1a-d). Holotype female, Daloh Forest, Erigavo, British Somaliland [Somalia] (BMNH); female and male paratypes, number unspecified, same data as holotype (BMNH, Hussey Collection).

TAXONOMY.—Hussey (1956b) compared this species to other species reared from seeds of *Juniperus*. Kapuscinski (1946, updated 1964) redescribed both sexes.

HOST.—The type series was reared from seeds of *Juniperus procera*.

PARASITE—This species was reportedly parasitized by a species of *Bracon* (Braconidae) (Hussey 1956b).

speciosus Girault. AUSTRALIAN: Australia (Queensland).

Megastigmus speciosus Girault 1915/243:300. Holotype female, Gordonvale (Cairns), Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species.

specularis Walley. NEARCTIC (from Milliron 1949): United States (New Hampshire, Massachusetts, Minnesota); Canada (New Brunswick). PALEARCTIC (introduced): Northern and western Europe, extending to western Siberia (Roques and Skrzypczynska in prep.).

Megastigmus specularis Walley 1932:187-188. Holotype female, New Brunswick, Canada (CNC); 1 female, 1 male paratype same data as holotype (CNC).

Megastigmus grönblomi Kangas 1945:177-180 (Figs. 1-6). Female and male syntypes,

number unstated, Tampere, Finland (MZUH, according to Hussey 1954). [Synonymized by Bouček 1970b:267.]

TAXONOMY.—This species was redescribed by Milliron (1949) who illustrated the forewing stigma. Hussey (1954) also redescribed the female and male, based upon syntype material. Zerova and Seryogina (1994) redescribed both sexes and illustrated the female, as did Roques and Skrzypczynska (in prep.) who also illustrated the male.

HOSTS.—The types of *specularis* were reared from seeds of *Abies balsamea*, and the types of *groenblomi* from *Abies sibirica*. In its native range, *specularis* has also been reared from *A. fraseri* (Hedlin et al. 1980). In Europe *specularis* attacks the introduced hosts *Abies balsamea*, *A. lasiocarpa*, *A. concolor*, and *A. amabilis*; it has host-shifted onto indigenous hosts as follows: *Abies sibirica*, *A. nephrolepis*, *A. sachalinensis*, and *A. veitchii*. Several Eurasian species were attacked including *A. alba*, *A. holophylla*, and *A. koreana*. All records are from Annila (1970).

BIOLOGY.—Zerova and Seryogina (1994) illustrated damaged seed. The sex ratio is 1:1 (Annila 1970).

spermotrophus Wachtl. NEARCTIC: United States (California, Oregon, Washington, Idaho, Colorado, New Mexico [Keen 1958]); Canada (British Columbia [Keen 1958]); Mexico (Nuevo Leon, Hidalgo [Cibrian-Tovar et al. 1995]). PALEARCTIC (introduced): "Widespread all over Europe" including Mediterranean countries (Roques and Skrzypczynska in prep.). AUSTRALIAN (introduced): New Zealand (Keen 1958).

Megastigmus spermotrophus Wachtl 1893:26-28 (Figs. 1-3). Female and male syntypes, number unspecified, northwestern America (depository unknown).

TAXONOMY.—Crosby (1909) and Escherich (1938) both photo-illustrated the female and male of this species. Hoffmeyer (1929) illustrated the female and male stigmal veins. The species was redescribed by Milliron (1949) who illustrated the forewing stigma. Zerova and Seryogina (1994) redescribed and illustrated both sexes as did Roques and Skrzypczynska (in prep.). Hussey and Klingler (1954) reported that adult size was correlated with seed size.

HOSTS.—The types were reared from seeds of *Pseudotsuga douglasii* (now = *menziesii*). In its native range (Neactic), *spermotrophus* attacks the following seeds: *Pseudotsuga menziesii menziesii*, *P. m. glauca*, *P. macrocarpa*, *P. flahaulti* (now = *menziesii flahaulti*), and *P. macrolepis* (now = *guinieri*). In Europe *spermotrophus* attacks the following introduced species: *Pseudotsuga japonica*, *P. guinieri*, and *P. rehderi*. All records are from Roques and Skrzypczynska (in prep.). In New Zealand, the species attacks seeds of *Pseudotsuga menziesii* (Gourlay 1930). References to species of *Abies* as host (e.g., Crosby 1913, Hoffmeyer 1930) were dropped as incorrect according to Milliron (1949).

BIOLOGY.—According to MacDougall (1906a,b) this species had a single annual generation. Crosby (1909) reported emergence from two year old seed, and Doane et al. (1936) stated that about ten percent of mature larvae remained in the seed for two years. Immature stages were illustrated by Crosby (1909, egg, larva), MacDougall (1906b, larva), Vayssieres (1931, larva), Escherich (1938, larva), and Hussey (1955, egg, larva). Miller (1916) described female oviposition into cones of *P. menziesii* (as *douglasii*). The cones were about 1.5 inches in length, green, and had soft scales and seeds. Two to five mintues was required for oviposition, which occurred through several cone scales, not between them. Oviposition probably did not take place in older, hardened cones. From 50 to 150 eggs might be laid by each female (Hussey 1955). According to Niwa

and Overhulser (1992) and Rappaport et al. (1993) females did not discriminate between fertilized and unfertilized seed and they could oviposit and develop in unfertilized seeds just as well as in fertilized ones. Crosby (1909) and Escherich (1938) photo-illustrated seeds of Douglas fir showing exit holes. Zerova and Seryogina (1994) illustrated damaged seed. A rather lengthy overview was given by Hussey (1955), and other short notes include Gourlay (1930), Keen (1958), and Jespersen and Lomholdt (1983) who discussed the seasonal history of this species, described the eggs, and discussed the sex ratio. Sex ratio is variable according to location and year (Roques and Skrzypczynska in prep.).

PARASITES.—This species was parasitized by the pteromalids *Mesopolobus spermotrophus* (see Hussey 1955 for biology as *Amblymerus ?apicalis*) and *Pteromalus chrysos* (Sellenschlo 1984a).

ECONOMIC IMPORTANCE.—Milliron (1949) reviewed the economic importance of this species since 1896. It is especially damaging to plantation-grown Douglas fir (*Pseudotsuga taxifolia*) in Palearctic locations, where the native American tree is introduced. Roques (1981) stated that in some areas up to 96% of cones are infested.

***spermotrophus nigrodorsatus* Milliron. NEARCTIC: United States (California).**

Megastigmus spermotrophus nigrodorsatus Milliron 1949:316-317 (Fig. 30). Holotype female, Figueroa Mt., California, USA (USNM, examined); 1 paratype male, same data as holotype (USNM); 3 paratype males, San Bernardino, California, USA (USNM, UM).

HOST.—The type and paratypes were reared from seeds of *Pseudotsuga macrocarpa* (Torr.) Mayr.

PARASITES.—Possibly parasitized by a species of *Tetrastichus* (Eulophidae) (Keen 1958).

***stigmatizans* (Fabricius). PALEARCTIC : Europe.**

Ichneumon stigmatizans Fabricius 1798:230 (Nr. 212-13). Female, number unknown, France (?MNHN, Bosc Collection).

Cleptes stigma Fabricius 1804:155 (Nr. 5). [?Unnecessary emendation.]

Megastigmus giganteus Walker 1852:39 and 1869:313. [*Nomen nudum*]

HOSTS.—Mayr (1874) and Milliron (1949) summarized the following list of cynipid hosts, many of which have been repeated in subsequent literature [in the following list, the currently correct valid name is given first with the original name cited in parentheses]: *Andricus* (as *Cynips*) *argentea*, *A. caput-medusae* (as *Cynips caput-medusae*), *A. gallaeinctoriae* (as *Cynips tinctoriae*), *A. (as Cynips) glutinosa*, *A. (as Cynips) kollari*, *A. (as Aphilothrix) lucidus*, *A. quercuscalicis* (as *Cynips calicis*), *Cynips divisa*, and *Neuroterus numismalis*. Sellenschlo (1984b) listed also *Andricus coriarius* and *A. dentimitratus*.

BIOLOGY.—Sellenschlo (1984b) discussed the biology of this species, which attacks *Andricus kollari* and *Andricus quercuscalicis*. Adults emerged from late May to late June and laid eggs from August to September. Some larvae pupated by October and November, but others did not pupate until May of the following year.

MORPHOLOGY.—Domenichini (1953) presented a short description of the abdominal morphology of this species. Sellenschlo (1984b,c, 1989) illustrated the larva.

strobilobius Ratzeburg. PALEARCTIC: "Western Europe to Lake Baikal" (Roques and Skrzypczynska in prep.), Siberia (Stadnitskii et al. 1978); People's Republic of China (Heilongjiang [Roques and Skrzypczynska in prep.]).

Megastigmus strobilobius Ratzeburg 1848:182. Female, number unknown, Germany, (NMW, type probably destroyed in WW II, see Graham 1969).

Megastigmus abietis Seitner 1916:309-311 (Figs. 43-49). Female and male syntypes, number unknown, Germany (NMW). [Synonymized by Escherich 1938:368]

TAXONOMY.—Hoffmeyer (1929, as *abietis*) and Escherich (1938) illustrated the female and male stigmal veins. Escherich (1938) also illustrated the adult female. Bouček (1970b) illustrated the mesoscutum of this species in comparison to *M. atedius*. Escherich (1938) examined the Razteburg type and material of Seitner (*abietis*), which at that time were in the Vienna Museum. Zerova and Seryogina (1994) redescribed both sexes and illustrated the female (habitus). Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male.

HOSTS.—The types of *abietis* were reared from seeds of *Picea excelsa* (now = *abies*). Roques and Skrzypczynska (in prep.) stated that *Picea abies* and *P. obovata* were hosts within the natural range of *M. strobilobius*. Host shifting occurred on the following introduced hosts: *Picea orientalis*, *P. asperata*, *P. montigena*, and *P. glehnii*. Roques and Skrzypczynska (in prep.) dismissed hosts in the genus *Abies*.

BIOLOGY.—Seitner (1916) described the biology of this species (as *abietis*) as well as the larva and pupa. Rearings in the laboratory required three years for emergence from seed, but under natural conditions a generation took two years. One female lived nearly 60 days under laboratory conditions. Zerova and Seryogina (1994) illustrated the damaged seed and cone. Roques and Skrzypczynska (in prep.) showed that the sex ratio was quite variable.

sulcicollis Cameron. AUSTRALIAN: Australia (New South Wales).

Megastigmus sulcicollis Cameron 1912:644. Female lectotype (designated by Bouček 1988), Richmond, New South Wales, Australia (BMNH).

TAXONOMY.—The description was repeated by Girault (1915/243). The female lectotype is marked by an arrow (one of four specimens), designated by Bouček (1988).

HOST.—The types were reared from flower-galls on kurrajong, *Brachychiton populneum*.

suspectus Borries. PALEARCTIC: "Widespread in Europe to the Caucasus" (Roques and Skrzypczynska in prep.), Japan.

Megastigmus suspectus Borries 1895:29. Female syntypes, number unknown, Denmark (ZMUC, according to Hussey 1954).

Megastigmus piceae Seitner 1916:315-317 (Figs. 50-55). Female syntypes, number unknown, Germany (?NMW). [Synonymized by Escherich 1938:369]

Megastigmus bornmulleriana Hussey 1957:253 (Figs. B1, B2, B4). Holotype female, Yenice, Turkey (BMNH, according to Bouček 1970b). [Synonymized by Bouček 1970b:269]

TAXONOMY.—Hoffmeyer (1929) illustrated the stigma of the female and later (1930) the male. Escherich (1938) illustrated the adult female and male. Hussey (1954) redescribed the female of *suspectus* based in part upon paratype specimens. In his description of *bornmulleriana*, Hussey (1957) mixed up figures 3 and 4, and the captions should be reversed. Skrzypczynska (1978) illustrated all the life stages of this species. Pintureau et al. (1991) discussed the taxonomy of this species relative

to *pinsapinis* based on electrophoretic study. Zerova and Seryogina (1994) redescribed and illustrated both sexes with habitus drawings. Roques and Skrzypczynska (in prep.) redescribed and illustrated the female and male.

HOSTS.—The types of *suspectus* were reared from seeds of *Abies pectinata* (now = *alba*); the type of *bornmulleriana* was reared from *Abies bornmulleriana* (now = *nordmanniana equitrojani*). Roques and Skrzypczynska (in prep.) summarized the hosts of this species in its host's natural range: *Abies alba*, *A. bornmulleriana* (now = *nordmanniana equitrojani*), *A. cephalonica*, and *A. nordmanniana*. In arboreta it also attacked the introduced firs: *Abies sibirica*, *A. borisiiregis*, *A. cilicica*, *A. nebrodensis*, *A. numidica*, and *A. pinsapo*; and from North America it attacked *A. grandis* and *A. concolor* (Roques and Skrzypczynska in prep.). It may also attack *Cedrus brevifolia* in arboreta (Roques and Skrzypczynska in prep.).

BIOLOGY.—Seitner (1916) stated that this species (as *piceae*) required one to two years to complete development, and this was confirmed by Skrzypczynska (1978). According to Skrzypczynska (1978), females laid an average of 42 eggs (range 32-60). Females could live over 50 days (Seitner 1916). Zerova and Seryogina (1994) illustrated damaged seed. Roques and Skrzypczynska (in prep.) stated that males were rare and that the species reproduces by thelytokous parthenogenesis.

MORPHOLOGY.—Domenichini (1953) presented a short description of the abdominal morphology of this species.

ECONOMIC IMPORTANCE.—Skrzypczynska (1978) stated that damage to fir seed averaged almost 6% (range 2-20%), and she cited other authors who had found up to 63% damage.

synophri Mayr. PALEARCTIC: Austria.

Megastigmus synophri Mayr 1874:129-130. Female and male syntypes (number unstated), Austria (?NMW).

HOST.—The syntypes were reared from *Synophrus politus* (Cynipidae). The species also attacks *Andricus glutinosus* (Cynipidae; Wall 1984).

MORPHOLOGY.—Domenichini (1953) presented a short description of the abdominal morphology of this species.

tasmaniensis Girault. AUSTRALIAN: Australia (Tasmania).

Megastigmus tasmaniensis Girault 1913/175:80. Holotype female, Tasmania, Australia (SAM).

TAXONOMY.—The description was repeated by Girault (1915/243).

HOST.—The type was reared from larvae of flies attacking *Helichryrum* [= *Helichrysum*] *scorpioides*.

thomseni (Hussey). AFROTROPICAL: South Africa (Mpumalanga).

Eumegastigmus thomseni Hussey 1956a:159-161 (Figs. 1c,d). Holotype female, Wolhuitenskop, Transvaal, South Africa (BMNH); 4 female, 2 male paratypes same data as holotype (BMNH, Hussey Collection).

TAXONOMY.—Bouček (1978:129) transferred the species.

HOSTS.—The types were reared from seeds of "witharpuisbos", a common name that Hussey suggested might refer to *Heeria* sp. My colleague, Gerhard Prinsloo, Pretoria, South Africa, informs me (pers. comm.) that the common name applies to *Ozoroa* sp., from which he subsequently reared the *M. thomseni*.

thyopsis Yano. PALEARCTIC: Japan.

Megastigmus thyopsis Yano (in Yano and Koyama) 1918a:46 (and again in 1918b:374).

Syntypes, (number unknown), Japan (destroyed by fire according to Kamijo 1962:31).

TAXONOMY.—Kamijo (1962:33) redescribed and illustrated the female as did Zerova and Seryogina (1994).

HOST.—The types were reared from seeds of *Thujopsis dolabrata*.

thyoides Kamijo. NEARCTIC: United States (North Carolina).

Megastigmus thyoides Kamijo in Turgeon et al. 1997:608-610 (Figs. 1-4). Holotype female, Dare County, North Carolina, USA (CNC); 14 female, 15 male paratypes same data as holotype (CNC, USNM [examined], HU).

TAXONOMY.—Turgeon et al. (1997) presented modified key couplets to integrate this species into Milliron's Nearctic key (1949).

HOST.—The types were reared from seeds of *Chamaecyparis thyoides*.

BIOLOGY.—Seed infestation rate appeared to be less than 15% based on sampling from several different areas in North Carolina.

tostini Girault. AUSTRALIAN: Australia (Western Australia).

Megastigmus tostini Girault 1934/443:2. Syntypes (number unspecified), West Australia, Australia (WADA).

TAXONOMY.—According to Dahms (1986) there are 1 female and 7 male syntypes on a single slide in WADA.

transvaalensis (Hussey). AFROTROPICAL: South Africa (Mpumalanga). NEARCTIC (introduced): United States (California [Harper and Lockwood 1961], Florida, Hawaii [Habeck et al. 1989]).

Eumegastigmus transvaalensis Hussey 1956a:161-162 (Figs. 1g,h, 4). Holotype female, Pretoria, Transvaal, South Africa (BMNH); 5 female, 8 male paratypes, same data as holotype (BMNH, Hussey Collection).

TAXONOMY.—The species was transferred by Bouček (1978:129).

HOSTS.—The types were reared from seeds of *Schinus molle* (a tree introduced into South Africa from South America). Habeck et al. (1989) reported it from *Schinus terebinthifolius* in Florida and Hawaii.

trisulcatus Girault. AUSTRALIAN: Australia (Queensland, Tasmania [Dahms 1986]).

Megastigmus (Epimegastigmus) trisulcatus Girault 1915/243:308. Holotype female, Brisbane, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species and listed other specimens seen by Girault.

HOST.—The species was reared from an unidentified gall.

trisulcus (Girault). AUSTRALIAN: Australia (New South Wales).

Epimegastigmus trisulcus Noble 1933:465. [*Nomen nudum*]

Epimegastigmus trisulcus Girault 1934/443:2. Holotype female, Wynnum, Brisbane, New South Wales, Australia (QM, examined).

TAXONOMY.—Gahan (in Noble 1938a:7) transferred the species to *Megastigmus*. Dahms (1986) discussed the type specimen.

HOSTS.—Noble (1933, 1936, 1938a) reported this species as a parasite of *Eurytoma* (now = *Bruchophagous*) *fellis* (Eurytomidae) on citrus. Dahms (1986) listed galls on "A. [Acacia] implexa" based on specimens examined by Girault.

BIOLOGY.—Noble (1938a) discussed the biology of this species. It is essentially identical to *Megastigmus brevivalvus* (refer to discussion of this species earlier in this paper).

tsugae Crosby. NEARCTIC: United States ("Western USA").

Megastigmus tsugae Crosby 1913:162 (Fig. 5). 2 female syntypes, "Western USA" (USNM, examined).

TAXONOMY.—This species was redescribed by Milliron (1949) who illustrated the forewing stigma.

HOSTS.—The types were reared from seeds of *Tsuga mertensiana hookeriana* (now = *grandis*). Keen (1958) reported *Tsuga heterophylla*. Hoffmeyer (1930) reported *Abies amabilis* as a host but Milliron (1949) discounted the record.

tsugae heterophyllae Milliron. NEARCTIC: Canada (British Columbia).

Megastigmus tsugae heterophyllae Milliron 1949:309-310 (Fig. 19). Holotype female, Vancouver, British Columbia, Canada (CNC). 3 male paratypes, same data (CNC, UM).

TAXONOMY.—This species was redescribed by Milliron (1949) who illustrated the forewing stigma.

HOST.—The holotype and paratypes were reared from seeds of *Tsuga heterophylla*.

tsugaphilus Kamijo. PALEARCTIC: Japan.

Megastigmus tsugaphilus Kamijo 1958:32-34 (Fig. 2A-C). Holotype female, Shikoku, Kochi Pref., Japan (HU); 13 female, 6 male paratypes, same data as holotype (HU).

TAXONOMY.—Zerova and Seryogina (1994) redescribed and illustrated both sexes.

HOST.—The types were reared from seeds of *Tsuga sieboldii*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the seed damage caused by this species.

validus Nikol'skaya. PALEARCTIC: Kirgistan.

Megastigmus validus Nikol'skaya 1966b:859. Holotype female, Alay range, Kara-Goy, Kirgistan (ZI); many female and male paratypes from numerous localities in Kirgistan (ZI).

TAXONOMY.—Zerova and Seryogina (1994) redescribed and illustrated the habitus of both sexes.

HOST.—The types were reared from seeds of *Juniperus turkestanica*.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the damaged seed and cone.

variegatus Strand. ?NEOTROPICAL: "Mexico."

Megastigmus variegatus Strand 1911b:93-99. Lectotype female, Mexico (ZMH, examined); 2 female paralectotypes, same data as holotype (ZMH, examined).

TAXONOMY.—Strand (1911b) compared his *variegatus* to *spermotrophus*, but Milliron (1949) placed it as an unrecognized species. I have examined the type series of this species and it is not apparent who made the lectotype designation. "Mexico" is the only locality data on the labels. This species is slightly atypical for *Megastigmus*. The upper face on either side of the scrobal depression projects distinctly forward.

viggianii Narendran and Sureshan. ORIENTAL: India (Kerala).

Megastigmus viggianii Narendran and Sureshan 1988:38-42 (Figs. I-1-6, II-1). Holotype female, Kerala, Kerala State, India (IEUN); 39 female, 8 male paratypes same data as holotype (IEUN, BMNH, USNM, Zoological Survey of India, University of Calicut, Kerala).

TAXONOMY.—Narendran (1994) repeated the original description of this species.

HOST.—The types were reared from bud galls on *Calycopterys floribunda*.

viridescens Kamijo. PALEARCTIC: Japan.

Megastigmus viridescens Kamijo 1962:23-24 (Fig. 1H,I). Holotype female, Tomakomai, Hokkaido, Japan (HU).

TAXONOMY.—Kamijo (1962) compared this species to *M. dorsalis*.

voltairei (Girault). AUSTRALIAN: Australia (Queensland).

Epimegastigmus voltairei Girault 1925/391:2. Holotype female, Little Mulgrave River, Queensland, Australia (QM, examined).

TAXONOMY.—Milliron (1949) transferred this species to *Megastigmus*, and Dahms (1986) discussed its type.

wachtli Seitner. PALEARCTIC: "Southeastern Mediterranean Basin" (Roques and Skrzypczynska in prep.).

Megastigmus wachtli Seitner 1916:320-321 (Figs. 56-60). Female and male syntypes, Istria [Croatia] and Dalmatia [Bosnia] (NMW).

TAXONOMY.—Escherich (1938) illustrated the adult male of this species. Kapuscinski (1964) redescribed both sexes. Roques and Skrzypczynska (in prep.) redescribed and illustrated the females and males of this species. Zerova and Seryogina (1994) redescribed both sexes and illustrated the male. Roques et al. (1998) discussed the genetic and evolutionary relationships of this species based on DNA analyses. Populations within the natural range were characterized by high polymorphism and populations within the introduced range were characterized by low polymorphism. Carcreff et al. (1998) discussed methodology for using primers to study variability of microsatellite loci.

HOSTS.—The syntypes were reared from *Cupressus sempervirens*. Roques and Skrzypczynska (in prep.) reported this species from the following seeds of indigenous European species of *Cupressus*: *C. atlantica* (now = *sempervirens atlantica*), *C. sempervirens*, and *C. dupreziana* (now = *sempervirens dupreziana*); they also reported it from the following trees introduced into Europe and North Africa from California: *Cupressus abramsiana* (now = *goveniana abramsiana*), *C. arizonica*, *C. bakeri*, *C. goveniana*, *C. macrocarpa*, and also *C. lusitanica* from Central America.

BIOLOGY.—Zerova and Seryogina (1994) illustrated the damaged seed and cone. The sex ratio varied from 0.5 to 1.7 males to females (Roques and Skrzypczynska in prep.).

ECONOMIC IMPORTANCE.—Roques and Rimbault (1986) stated that this species damaged up to 13% of seeds per cone.

walsinghami Girault. AUSTRALIAN: Australia (South Australia).

Megastigmus sulcicollis var. *walsinghami* Girault 1929/431:340. Female and male syntypes, Mt Lofty, South Australia, Australia (SAM (number unknown); 2 female, 3 male cotypes QM, examined).

TAXONOMY.—Dahms (1986) discussed the possibility that there were 14 syntypes and not 2 as stated in the original description. Bouček (1988) elevated the subspecies to species.

Neomegastigmus Girault

Neomegastigmus Girault 1915/234:47. Type species: *Neomegastigmus petiolatus* Girault (designated by Bouček 1988:125).

Neomegastigmus Girault 1915/243:294-295. Type species: *Neomegastigmus lividus* Girault (original designation).

TAXONOMY.—Bouček (1988:126) discussed the confusing taxonomy associated with the generic name.

NUMBER OF SPECIES.—7.

DISTRIBUTION.—All known species are from Australia.

HOST.—A single species has been reared from Cecidomyiidae (Diptera).

KEY TO SPECIES.—None.

collaris Girault. AUSTRALIAN: Australia (Queensland).

Neomegastigmus collaris Girault 1915/234:47. Holotype female, Thursday Island, Queensland, Australia (QM, examined).

TAXONOMY.—The description was repeated by Girault in the same year (1915/243). Dahms (1983) discussed the type of this species.

filius Girault. AUSTRALIAN: Australia (Queensland).

Neomegastigmus filius Girault 1915/243:295. Holotype female, Gordonvale, Queensland, Australia (QM, examined)

TAXONOMY.—Dahms (1984) discussed the type of this species.

lividus Girault. AUSTRALIAN: Australia (Queensland).

Neomegastigmus lividus Girault 1915/234:47. [Nomen nudum]

Neomegastigmus lividus Girault 1915/243:294-295. Holotype female, Gordonvale, Queensland, Australia (QM, examined).

Neomegastigmus lividus badius Girault 1915/243:297. Holotype female, Gordonvale, Queensland, Australia (not extant, Dahms 1984:761). [?Synonymized by Bouček 1988:126.]

TAXONOMY.—Dahms (1984) discussed the types of both names. It is not clear from the text whether Bouček (1988) synonymized the subspecies *badius*.

HOST.—The type of *lividus lividus* was reared from cecidomyiid galls on *Careya australis*; that of *lividus badius* from "tea-tree leaves" (= *Careya australis*).

petiolatus Girault. AUSTRALIAN: Australia (Queensland).

Neomegastigmus petiolatus Girault 1915/234:47. Holotype female, Mackay, Queensland, Australia (QM, examined).

Neomegastigmus rufithorax nelsonensis Girault 1915/243:296. Gordonvale, Queensland, Australia (QM, examined). [Synonymized by Bouček 1988:126.]

TAXONOMY.—The description for *petiolatus* was repeated by Girault in the same year (1915/243). Dahms (1986) discussed the types of *petiolatus*, but he gave the incorrect page numbers for Girault 1915/234 and Girault 1915/243. Bouček (1988:Figs. 167-168) illustrated the female wing and metasoma of this species.

rufithorax Girault. AUSTRALIAN: Australia (New South Wales).

Neomegastigmus rufithorax Girault 1915/243:296. Holotype female, Chinderah, New South Wales, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species. Bouček (1988) stated that it was close to *petiolatus*.

saltensis Girault. AUSTRALIAN: Australia (Queensland).

Neomegastigmus saltensis Girault 1915/243:295-296. Holotype female, Kuranda, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species.

varius Girault. AUSTRALIAN: Australia (Queensland).

Neomegastigmus varius Girault 1915/243:196. Holotype female, Gordonvale, Queensland, Australia (QM, examined).

TAXONOMY.—Dahms (1986) discussed the type of this species.

Paramegastigmus Girault

Paramegastigmus Girault 1915/243:306 (subgenus of *Megastigmus* Dalman). Type species: *Spilomegastigmus favus* Girault (original designation).

NUMBER OF SPECIES.—1.

DISTRIBUTION.—A single species is known from Australia.

HOST.—Associated with leaf galls on *Tristania* spp.

KEY TO SPECIES.—None.

flavus (Girault). AUSTRALIAN: Australia (Queensland).

Spilomegastigmus flavus Girault 1914/176:25. Holotype female, Gordonvale, Queensland, Australia (QM, examined).

Megastigmus (*Paramegastigmus*) *immaculaticorpus* Girault 1915/243:307. Holotype female, Gordonvale, Queensland, Australia (QM, examined). [Synonymized by Bouček 1988:129.]

TAXONOMY.—The description of *flavus* was repeated under *Megastigmus* (*Paramegastigmus*) by Girault 1915/243. Dahms (1984) discussed the type of *flavus* and *immaculaticorpus*. Bouček (1988) illustrated the female mesosoma and male antenna of this species.

BIOLOGY.—Bouček (1988) reported both sexes of this species swarming around the galled leaves of *Tristania* but no oviposition was observed.

Westralianus Bouček

Westralianus Bouček 1988:130. Type species: *Westralianus microstigma* Bouček (original designation and monotypy).

NUMBER OF SPECIES.—1.

DISTRIBUTION.—A single species is known from Australia.

HOST.—Unknown.

KEYS TO SPECIES.—None.

microstigma Bouček. AUSTRALIAN: Australia (West Australia).

Westralianus microstigma Bouček 1988:130 (Figs. 158-159). Holotype female, Cannington, West Australia, Australia (WAM).

Nomina Nuda

The following names have appeared in the literature but are not available nomenclaturally:

Bootanomyia unistriata Girault 1928/420:262 (see Bouček 1988).

Megastigmus giganteus Walker 1852:39 [see *Megastigmus stigmatizans* (Fabricius)]

Megastigmus indi Girault in Rāmakrishna Ayyar 1920:935; Mani 1938:43.

Megastigmus japonicus Yasumatsu 1955:100 [see *Megastigmus nipponicus* Yasumatsu and Kamijo]

Megastigmus limoni morleyi Girault 1940/460:106 (see Dahms 1984:756)

Megastigmus maculipennis Yasumatsu 1955:101 [see *Megastigmus maculipennis* Yasumatsu and Kamijo]

Megastigmus pistaciae Haliday, Walker 1869:313 [see *Megastigmus pistaciae* Walker]

Megastigmus slossonae Crosby 1913:157 [see *Megastigmus americanus* Milliron]

Megastigmus spenseri Girault 1929/431:340 (see Bouček 1988)

Epimegastigmus trisulcus Noble 1933:465 [see *Megastigmus trisulcus* (Girault)]

Megastigmus vexillum Ratzeburg 1848:182 [see *Megastigmus aculeatus* (Swederus)]

Neomegastigmus lividus Girault 1915/234:47 [see *Neomegastigmus lividus* Girault]

New Combinations Proposed in this Paper

Bortesia longistigmus (Riek) from *Xenostigmus*

Bortesia similis (Riek) from *Xenostigmus*

Species Recently Transferred to Other Genera

[see Grissell and Heydon (1999) for explanations]

Megastigmus flavipes Ashmead 1886:128 (nec 1888) now = *Gastrancistrus flavipes* (Ashmead) (Pteromalidae)

Megastigmus mendocinus Kieffer and Jørgensen 1910:410 now = junior synonym of *Torymoides sulcios* (Walker) (Torymidae: Toryminae).

ACKNOWLEDGMENTS

I thank the following for their contributions to this paper: Jennifer Miller obtained and arranged a considerable portion of the early literature used in this study; Terry Nuhn, Terri Taylor, and Erik Denno added later references; Chris Thompson provided needed information to convert the card-based bibliography to a database; Vera Lee typed the original card data into the database; Robert Carlson converted the database to Pro-Cite™ for the Macintosh. In checking current nomenclature for the host list, I especially thank George Metlka for helping with the Cynipidae nomenclature, Dug Miller for help with the Hemiptera names, and Bob Faden for help with some of the botanical names. For providing access to literature I thank David Furth for papers concerning *Megastigmus* and host plants in the Anacardiaceae. For access to their manuscript in preparation, and permission to cite some of their data, I particularly thank A. Roques and M. Skrzypeczynska.

For reading and suggesting comments for the improvement of this manuscript I am especially thankful to Stuart McKamey and David Smith, Systematic Entomology Laboratory, who discovered many major and minor inconsistencies in the original draft. I also thank Douglas Tallamy, University of Delaware, who made several suggestions for the improvement of this manuscript.

HOST LISTS FOR MEGASTIGMINAE

PHYTOPHAGOUS SPECIES

(Alphabetical by Family, Genus, Species)

Hybrid taxa, where known, are listed by the first named species of the hybrid. Plant host names were corrected for nomenclature based on the following sources: GRIN (USDA, National Genetic Resources Program, Germplasm Resources Information Network: <http://www.ars-grin.gov/index.html>); W³TROPICOS (Missouri Botanical Garden web site <http://mobot.mobot.org/Pick/Search/pick.html>), and Huxley et al. (1992). Host names that have changed subsequent to their appearance in the original literature are cited with the notation to "see" the species name, which is now the currently accepted name. Nominal subspecies are listed by the species name alone.

Anacardiaceae

Heeria sp. see *Ozoroa* sp.*Ozoroa* sp.: *Megastigmus thomseni* (Hussey)*Pistacia atlantica* Desf. x *vera* L.: *Megastigmus pistaciae* Walker*Pistacia atlantica* Desf.: *Megastigmus pistaciae* Walker*Pistacia chinensis* Bunge: *Megastigmus pistaciae* Walker*Pistacia integerrima* J. Stewart: *Megastigmus pistaciae* Walker*Pistacia lentiscus* L.: *Megastigmus pistaciae* Walker*Pistacia mutica* Fisch. & C. A. Mey: *Megastigmus pistaciae* Walker*Pistacia terebinthus* L.: *Megastigmus pistaciae* Walker*Pistacia vera* 'Kerman': *Megastigmus pistaciae* Walker*Pistacia vera* L.: *Megastigmus pistaciae* Walker*Rhus lancea* L.: *Megastigmus rhusi* (Hussey)*Schinus molle* L.: *Megastigmus transvaalensis* (Hussey)*Schinus terebinthifolius* Raddi: *Megastigmus pistaciae* Walker, *Megastigmus transvaalensis* (Hussey)

Araliaceae

Ilex x attenuata Ashe: *Megastigmus floridanus* Milliron*Ilex integra* Thunb.: *Bootania hirsutum* (Kamijo)*Ilex opaca* Sol.: *Megastigmus floridanus* Milliron*Ilex purpurea* Hasskarl: *Bootania japonicus* (Ashmead)*Ilex serrata* Thunb.: *Bootania japonicus* (Ashmead)*Ilex shinensis* (*chinensis*) see *Ilex purpurea*

Asteraceae

?Helianthus: *Megastigmus hypogaea* (Hussey) [more likely from insect host in flower head than from seeds]

Casuarinaceae

Casuarina equisetifolia L.: *Bootanelleus orientalis* (Mathur & Hussey)*Casuarina stricta* Aiton: *Bootanelleus orientalis* (Mathur & Hussey)

Cupressaceae

Chamaecyparis obtusa (Siebold & Zucc.) Endl.: *Megastigmus chamaecyparidis* Kamijo,

Megastigmus cryptomeriae Yano

Chamaecyparis thyoides (L.) Britton et al.: *Megastigmus thyoides* Kamijo

Cupressus abramsiana see *Cupressus goveniana abramsiana*

Cupressus arizonica Greene: *Megastigmus amicorum* Boueck, *Megastigmus wachtli* Seitner

Cupressus atlantica see *Cupressus sempervirens atlantica*

Cupressus bakeri Jeps.: *Megastigmus wachtli* Seitner

Cupressus duclouxiana Hickel: *Megastigmus carinus* Xu and He, *Megastigmus duclouxiana*

Roques and Pan

Cupressus dupreziana see *Cupressus sempervirens dupreziana*

Cupressus goveniana abramsiana (C. B. Wolf) Little: *Megastigmus wachtli* Seitner

Cupressus goveniana goveniana Gordon: *Megastigmus amicorum* Boueck, *Megastigmus wachtli* Seitner

Cupressus lusitanica Mill.: *Megastigmus wachtli* Seitner

Cupressus macrocarpa Hartw.: *Megastigmus wachtli* Seitner

Cupressus sempervirens atlantica (Gaussin) Silba: *Megastigmus wachtli* Seitner

Cupressus sempervirens dupreziana (A. Camus) Silba: *Megastigmus wachtli* Seitner

Cupressus sempervirens sempervirens L.: *Megastigmus wachtli* Seitner

Cupressus torulosa D. Don: *Megastigmus cupressi* Mathur, *Megastigmus duclouxiana* Roques and Pan

Juniperus communis alpina (Suter) Celak: *Megastigmus bipunctatus* (Swederus)

Juniperus communis siberica L.: *Megastigmus bipunctatus* (Swederus), *Megastigmus fidus*

Nikol'skaya

Juniperus convallium Rehd. et Wils.: *Megastigmus sabinae* Xu and He

Juniperus excelsa M. Bieb.: ?*Megastigmus amicorum*, ?*Megastigmus bipunctatus* (Swederus),
?*Megastigmus gravis* Nikol'skaya

?*Juniperus excelsa* M. Bieb.: *Megastigmus amicorum* Boueck

Juniperus foetidissima Willd.: *Megastigmus gravis* Nikol'skaya

Juniperus komarovii Florin: *Megastigmus sabinae* Xu and He

Juniperus nana see *Juniperus communis alpina*

Juniperus oxycedrus L.: *Megastigmus amicorum* Boueck

Juniperus phoenicea L.: *Megastigmus amicorum* Boueck

Juniperus pingii Cheng: *Megastigmus pingii* Roques and Sun

Juniperus procera Hochst.: *Megastigmus somaliensis* Hussey

Juniperus przewalskii Kom.: *Megastigmus sabinae* Xu and He

Juniperus pseudosabina Fisch. & C.A. Mey.: *Megastigmus juniperi* Nikol'skaya, *Megastigmus validus* Nikol'skaya

?*Juniperus pseudosabina* Fisch. & C. A. Mey.: *Megastigmus fidus* Nikol'skaya

Juniperus sabina L.: *Megastigmus bipunctatus* (Swederus), *Megastigmus certus* Nikol'skaya,
?*Megastigmus fidus* Nikol'skaya

Juniperus saltuaria Rehder & E. H. Wilson: *Megastigmus sabinae* Xu and He

Juniperus semiglobosa Regel: *Megastigmus certus* Nikol'skaya, *Megastigmus juniperi*
Nikol'skaya

?*Juniperus semiglobosa* Regel: *Megastigmus fidus* Nikol'skaya

Juniperus seravschanica Kom.: *Megastigmus juniperi* Nikol'skaya

?*Juniperus seravschanica* Kom.: *Megastigmus fidus* Nikol'skaya

Juniperus siberica see *Juniperus communis siberica*

Juniperus thurifera L.: *Megastigmus amicorum* Boueck, *Megastigmus bipunctatus* (Swederus)

Juniperus tibetica Kom.: *Megastigmus sabinae* Xu and He

Juniperus turkestanica see *Juniperus pseudosabina*

Sabina spp. see *Juniperus* spp.

Thujopsis dolabrata (Thunb.) Siebold & Zucc.: *Megastigmus thuyopsis* Yano

Fabaceae

Albizia odoratissima (L. f.) Benth.: *Megastigmus albizziae* Mukerji

Albizia lebbeck (L.) Benth.: *Megastigmus albizziae* Mukerji

Dalbergia sericea G. Don: *Megastigmus leeuweni* Ferriere

Milletia sericea see *Dalbergia sericea*

Hamamelidaceae

Distylium racemosum Siebold & Zucc.: *Megastigmus distylii* Kamijo

Pandanaceae

Pandanus tectorius neocaledonicus Martelli: *Bootania neocaledonica* (Milliron).

Pandanus upoluensis Martelli: *Bootania maxima* (Strand)

Pandanus sp.: *Bootania solomonensis* (Milliron)

Pinaceae

Abies alba Mill: *Megastigmus milleri* Milliron, *Megastigmus pinsapinis* Hoffmeyer,

Megastigmus specularis Walley, *Megastigmus suspectus* Borries

Abies amabilis Douglas: *Megastigmus lasiocarpae* Crosby, *Megastigmus pinus* Parfitt,

Megastigmus specularis Walley

?*Abies amabilis* Douglas: *Megastigmus tsugae heterophyllae* Milliron

Abies balsamea (L.) Mill.: *Megastigmus specularis* Walley

Abies borisiiregis Mattf.: *Megastigmus suspectus* Borries

Abies bornmuelleriana see *Abies nordmanniana equitrojani*

Abies bracteata (D. Don) Nutt.: *Megastigmus pinus* Parfitt

Abies cephalonica Loudon: *Megastigmus rafni* Hoffmeyer, *Megastigmus suspectus* Borries

Abies cilicica (Antoine & Kotschy) Carriere: *Megastigmus pinus* Parfitt, *Megastigmus rafni*

Hoffmeyer, *Megastigmus suspectus* Borries

Abies concolor (Gordon & Glend.) Lindl.: *Megastigmus pinus* Parfitt, *Megastigmus rafni*

Hoffmeyer, *Megastigmus specularis* Walley, *Megastigmus suspectus* Borries

Abies firma Siebold & Zucc.: *Megastigmus firmae* Kamijo

Abies fraseri (Pursh) Poir.: *Megastigmus specularis* Walley

Abies grandis (Douglas) Lindl.: *Megastigmus pinus marginatus* Hoffmeyer, *Megastigmus milleri*

Milliron, *Megastigmus pinus* Parfitt, *Megastigmus rafni* Hoffmeyer, *Megastigmus suspectus* Borries

Abies holophylla Maxim.: *Megastigmus specularis* Walley

Abies koreana E. H. Wilson: *Megastigmus specularis* Walley

Abies lasiocarpa (Hook.) Nutt.: *Megastigmus lasiocarpae* Crosby, *Megastigmus pinus* Parfitt,

Megastigmus specularis Walley

- Abies magnifica magnifica* A. Murray: *Megastigmus milleri* Milliron, *Megastigmus pinus* Parfitt, *Megastigmus rafni* Hoffmeyer
Abies magnifica shastensis Lemmon: *Megastigmus milleri* Milliron, *Megastigmus pinus* Parfitt, *Megastigmus rafni* Hoffmeyer
Abies mariesii Mast.: *Megastigmus borriesi* Crosby
Abies marocana see *Abies pinsapo marocana*
Abies nebrodensis (Lojac.) Mattei: *Megastigmus suspectus* Borries
Abies nephrolepis (Trautv.) Maxim.: ?*Megastigmus borriesi* Crosby, *Megastigmus specularis* Walley
Abies nobilis (Douglas) Lindl.: *Megastigmus pinus* Parfitt
Abies nordmanniana equitrojani (Asch. & Sint.) Coode & Cullen: *Megastigmus pinus* Parfitt, *Megastigmus rafni* Hoffmeyer, *Megastigmus suspectus* Borries
Abies nordmanniana nordmanniana (Steven) Spach: *Megastigmus pinsapinis* Hoffmeyer, *Megastigmus rafni* Hoffmeyer, *Megastigmus suspectus* Borries
Abies numidica de Lannoy: *Megastigmus pinus* Parfitt, *Megastigmus rafni* Hoffmeyer, *Megastigmus suspectus* Borries
Abies pectinata see *Abies alba*
Abies pinsapo marocana (Trabut) Ceballos & Bolanos: *Megastigmus rafni* Hoffmeyer
Abies pinsapo Boiss.: *Megastigmus pinsapinis* Hoffmeyer, *Megastigmus pinus* Parfitt, *Megastigmus rafni* Hoffmeyer, *Megastigmus suspectus* Borries
Abies procera Rehder: *Megastigmus rafni* Hoffmeyer, *Megastigmus pinus* Parfitt
Abies sachalinensis (F. Schmidt) Mast.: *Megastigmus borriesi* Crosby, *Megastigmus specularis* Walley
Abies shastensis see *Abies magnifica shastensis*
Abies sibirica Ledeb.: *Megastigmus lasiocarpae* Crosby, *Megastigmus specularis* Walley, *Megastigmus suspectus* Borries
Abies sikokiana see *Abies veitchii sikokiana*
Abies veitchii sikokiana Nakai: *Megastigmus borriesi* Crosby, *Megastigmus specularis* Walley
Abies venusta see *Abies bracteata*

Cedrus atlantica (Endl.) Carriere: *Megastigmus pinsapinis* Hoffmeyer
Cedrus brevifolia (Hook.) A. Henry: *Megastigmus pinsapinis* Hoffmeyer, *Megastigmus schimitscheki* Novitzky
?*Cedrus brevifolia*: *Megastigmus suspectus* Borries
Cedrus deodara (Roxb.) G. Don: *Megastigmus pinsapinis* Hoffmeyer
Cedrus libani A. Rich: *Megastigmus pinsapinis* Hoffmeyer, *Megastigmus schimitscheki* Novitzky

“conifer” seed: *Megastigmus cellus* Xu and He, *Megastigmus pseudomali* Xu and He

Larix x czekanowskii Szafer: *Megastigmus pictus* (Förster)
Larix dahurica see *Larix gmelinii gmelinii*
Larix decidua polonica (Racib.) Domin: *Megastigmus pictus* (Förster)
Larix decidua decidua Mill.: *Megastigmus pictus* (Förster)
Larix x eurolepis A. Henry: *Megastigmus pictus* (Förster)
Larix europea see *Larix decidua*
Larix gmelinii gmelinii (Rupr.) Rupr.: *Megastigmus inamurae* Yano, *Megastigmus pictus* (Förster)

- Larix gmelinii olgensis* : *Megastigmus pictus* (Förster)
Larix gmelinii principisrupprechtii (Mayr) Pilg.: *Megastigmus pictus* (Förster)
Larix kaempferi (Lamb.) Carriere: *Megastigmus inamurae* Yano, *Megastigmus pictus* (Förster),
 Megastigmus pictus (Förster)
Larix laricina (DuRoi) K. Koch: *Megastigmus laricis* Marcovitch
Larix leptolepis see *Larix kaempferi*
Larix olgensis see *Larix gmelinii olgensis*
Larix olgensis koreana see *Larix gmelinii olgensis*
Larix principisrupprechtii see *Larix gmelinii principisrupprechtii*
Larix sibirica Ledeb.: *Megastigmus pictus* (Förster)
Larix sukaczewii N. Dyl.: *Megastigmus pictus* (Förster)
- Picea abies* (L.) H. Karst.: *Megastigmus atedius* Walker, *Megastigmus strobilobius* Ratzeburg
Picea asperata Mast.: *Megastigmus strobilobius* Ratzeburg
Picea engelmanni (Parry) Engelm.: *Megastigmus atedius* Walker, *Megastigmus atedius montana*
 Milliron
Picea excelsa see *Picea abies*
Picea glauca (Moench) Voss: *Megastigmus atedius* Walker
Picea glehnii (F. Schmidt) Mast.: *Megastigmus ezomatsuanus* Hussey and Kamijo, *Megastigmus strobilobius* Ratzeburg
Picea jezoensis (Siebold & Zucc.) Carriere: *Megastigmus ezomatsuanus* Hussey and Kamijo
Picea koraiensis Nakai: *Megastigmus ezomatsuanus* Hussey and Kamijo
Picea likiangensis (Franch.) E. Pritz.: *Megastigmus likiangensis* Roques and Sun
Picea montigena Mast.: *Megastigmus strobilobius* Ratzeburg
Picea nigra (Arnold) Link: *Megastigmus atedius* Walker
Picea obovata Ledeb.: *Megastigmus ezomatsuanus* Hussey and Kamijo, *Megastigmus strobilobius* Ratzeburg
Picea orientalis (L.) Link: *Megastigmus atedius* Walker, *Megastigmus strobilobius* Ratzeburg
Picea parryana Sarg.: *Megastigmus atedius* Walker
Picea pungens Engelm.: *Megastigmus atedius* Walker
Picea sitchensis (Bong.) Carriere: *Megastigmus atedius* Walker
- Pinus arizonica* Engelm.: *Megastigmus albifrons* Walker
Pinus ayacahuite ayacahuite Ehrenb.: *Megastigmus albifrons* Walker
Pinus ayacahuite brachyptera see *Pinus strobiformis*
Pinus ayacahuite veitchii (Roezl) Shaw: *Megastigmus albifrons* Walker
Pinus contorta murrayana (Balf.) Engelm.: *Megastigmus albifrons* Walker, *Megastigmus atedius*
 Walker
Pinus devoniana Lindl.: *Megastigmus albifrons* Walker
Pinus engelmannii Carriere: *Megastigmus albifrons* Walker
Pinus hartwegii Lindl.: *Megastigmus albifrons* Walker
Pinus michoacana (= *michoacensis*) see *Pinus devoniana*
Pinus montezumae Lamb.: *Megastigmus albifrons* Walker
Pinus ponderosa Douglas: *Megastigmus albifrons* Walker
Pinus pseudostrobus Lindl.: *Megastigmus albifrons* Walker
Pinus rufa see *Pinus hartwegii*
Pinus strobiformis Engelm.: *Megastigmus albifrons* Walker
Pinus strobus L.: *Megastigmus atedius* Walker

Pseudotsuga douglasii see *Pseudotsuga menziesii*
Pseudotsuga flahaultii see *Pseudotsuga menziesii flahaultii*
Pseudotsuga gaussenii Flous: *Megastigmus pseudotsugaphilus* Xu and He
Pseudotsuga guinieri Flous: *Megastigmus spermotrophus* Wachtl
Pseudotsuga japonica (Shiras.) Beissner: *Megastigmus spermotrophus* Wachtl
Pseudotsuga macrocarpa (Vasey) Mayr: *Megastigmus spermotrophus nigrodorsatus* Milliron,
Megastigmus spermotrophus Wachtl

Pseudotsuga macrolepis see *Pseudotsuga guinieri* Flous
Pseudotsuga menziesii flahaultii Flous: *Megastigmus spermotrophus* Wachtl
Pseudotsuga menziesii glauca (Beissner) Franco: *Megastigmus spermotrophus* Wachtl
Pseudotsuga menziesii menziesii (Mirb.) Franco: *Megastigmus spermotrophus* Wachtl
Pseudotsuga rehderi Flous: *Megastigmus spermotrophus* Wachtl

Tsuga canadensis (L.) Carriere: *Megastigmus hoffmeyeri* Walley
Tsuga heterophylla (Raf.) Sarg.: *Megastigmus tsugae heterophyllae* Milliron, *Megastigmus tsugae tsugae* Crosby
Tsuga mertensiana hookeriana see *Tsuga mertensiana grandicona*
Tsuga mertensiana grandicona Farjon: *Megastigmus tsugae tsugae* Crosby
Tsuga sieboldii Carriere: *Megastigmus tsugaphilus* Kamijo

Poaceae
bamboo shoots: *Megastigmus sinensis* Sheng

Rosaceae
Amelanchier canadensis (L.) Medik.: *Megastigmus amelanchieris* Cushman
Amelanchier laevis Wiegand x *humilis* Wiegand: *Megastigmus amelanchieris* Cushman
Amelanchier ovalis Medik.: *Megastigmus brevicaudis* Ratzeburg
Amelanchier sanguinea (Pursh) DC.: *Megastigmus amelanchieris* Cushman
Amelanchier spicata (Lam.) K. Koch: *Megastigmus brevicaudis* Ratzeburg

Cotoneaster dielsianus Prits.: *Megastigmus cotoneastri* Nikol'skaya
Cotoneaster insignis Pojark.: *Megastigmus cotoneastri* Nikol'skaya
Cotoneaster nummularius Fisch. & C. A. Mey: *Megastigmus cotoneastri* Nikol'skaya
Cotoneaster rhytidophyllus Rehd. & Wils.: *Megastigmus cotoneastri* Nikol'skaya
Cotoneaster tauricus Pojark.: *Megastigmus cotoneastri* Nikol'skaya

?*Crataegus* sp.: *Megastigmus formosus* Milliron

Malus baccata (L.) Borkh.: *Megastigmus mali* Nikol'skaya
Malus pallasiana Juz.: *Megastigmus mali* Nikol'skaya

Pyrus pallasiana see *Malus pallasiana*

Rosa acicularis Lindl.: *Megastigmus nigrovariegatus* Ashmead
Rosa alpina see *Rosa pendulina*
Rosa arkansana Porter: *Megastigmus nigrovariegatus* Ashmead
Rosa arvensis Huds.: *Megastigmus aculeatus* (Swederus), *Megastigmus rosae* Bouček
Rosa beggeriana Shrenk: *Megastigmus aculeatus* (Swederus)

- Rosa blanda* Aiton: *Megastigmus nigrovariegatus* Ashmead
- Rosa californica* Cham & Schleidl.: *Megastigmus nigrovariegatus* Ashmead
- Rosa canina* L.: *Megastigmus aculeatus* (Swederus), *Megastigmus nigrovariegatus* Ashmead,
Megastigmus rosae Bouček
- Rosa carolina carolina* L.: *Megastigmus nigrovariegatus* Ashmead
- Rosa carolina villosa* (Best) Rehder: *Megastigmus aculeatus* (Swederus)
- Rosa cinnamomea* see *Rosa pendulina*
- Rosa x collina* Jacq.: *Megastigmus aculeatus* (Swederus)
- Rosa davurica* Pall.: *Megastigmus aculeatus* (Swederus)
- Rosa eglanteria* see *Rosa rubiginosa*
- Rosa engelmannii* S. Watts: *Megastigmus nigrovariegatus* Ashmead
- Rosa ferruginea* Vill.: *Megastigmus aculeatus* (Swederus), *Megastigmus rosae* Bouček
- Rosa gallica* L.: *Megastigmus aculeatus* (Swederus), *Megastigmus aculeatus nigroflavus*
Hoffmeyer
- Rosa glutinosa* see *Rosa pulverulenta*
- Rosa jundzilli* Besser: *Megastigmus aculeatus* (Swederus)
- Rosa kokanica* Regel & Juz.: *Megastigmus rosae kondaricus* Zerova and Seryogina
- Rosa lunelli* Greene: *Megastigmus nigrovariegatus* Ashmead
- Rosa macounii* see *Rosa woodsii*
- Rosa mollissima* Willd.: *Megastigmus aculeatus* (Swederus)
- Rosa montana* Chaix & Vill.: *Megastigmus aculeatus* (Swederus)
- Rosa multiflora* Thunb.: *Megastigmus aculeatus* (Swederus), *Megastigmus aculeatus nigroflavus*
Hoffmeyer
- Rosa nutkana hispida* Fern.: *Megastigmus nigrovariegatus* Ashmead
- Rosa palustris* Marshall: *Megastigmus nigrovariegatus* Ashmead
- Rosa pendulina* L.: *Megastigmus aculeatus* (Swederus), *Megastigmus nigrovariegatus* Ashmead,
Megastigmus rosae Bouček
- Rosa pimpinellifolia* L.: *Megastigmus aculeatus* (Swederus), *Megastigmus nigrovariegatus*
Ashmead
- Rosa pulverulenta* M. Bieb.: *Megastigmus aculeatus* (Swederus)
- Rosa pouzinii* Tratt: *Megastigmus aculeatus* (Swederus)
- Rosa pyrifera* Rybd.: *Megastigmus nigrovariegatus* Ashmead
- Rosa rubiginosa* L.: *Megastigmus aculeatus* (Swederus), *Megastigmus nigrovariegatus* Ashmead,
Megastigmus rosae Bouček
- Rosa rugosa* Thunb.: *Megastigmus aculeatus* (Swederus), *Megastigmus nigrovariegatus* Ashmead
- Rosa setigera* Michx.: *Megastigmus nigrovariegatus* Ashmead
- ?*Rosa* sp.: *Megastigmus formosus* Milliron
- Rosa spaldingii* see *Rosa nutkana hispida*
- Rosa spinosissima* see *Rosa pimpinellifolia*
- Rosa suffulta* Greene: *Megastigmus nigrovariegatus* Ashmead
- Rosa tschatyrdagi* Chrshan.: *Megastigmus rosae* Bouček
- Rosa turkestanica* Regel: *Megastigmus aculeatus* (Swederus), *Megastigmus rosae* Bouček
- Rosa ultramontana* see *Rosa woodsii ultramontana*
- Rosa villosa* see *Rosa carolina villosa*
- Rosa virginiana* Mill.: *Megastigmus nigrovariegatus* Ashmead
- Rosa woodsii ultramontana* (S. Watson) Jeps: *Megastigmus nigrovariegatus* Ashmead
- Rosa woodsii woodsii* Lindl.: *Megastigmus nigrovariegatus* Ashmead
- Rosa xanthina* Lindl.: *Megastigmus nigrovariegatus* Ashmead

Photinia villosa (Thunb.) DC.: *Megastigmus pourthiaeae* Kamijo
?Physocarpus malvaceus (Greene) Kuntze: *Megastigmus physocarpi* Crosby
?Physocarpus monogynus (Torr.) J. M. Coulter: *Megastigmus physocarpi* Crosby
Physocarpus opulifolius intermedius (Rydb.) B. L. Robins: *Megastigmus gahani* Milliron,
Megastigmus physocarpi Crosby
Physocarpus opulifolius opulifolius (L.) Maxim.: *Megastigmus physocarpi* Crosby
Pourthiae villosa see *Photinia villosa*

Sorbus aria (L.) Crantz: *Megastigmus brevicaudis* Ratzeburg
Sorbus aucuparia L.: *Megastigmus amelanchieris* Cushman, *Megastigmus brevicaudis* Ratzeburg
?Sorbus aucuparia L.: *Megastigmus americanus* Milliron
Sorbus scandica see *Sorbus aria*

Taxodiaceae

Cryptomeria fortunei Hooibrenk.: *Megastigmus cryptomeriae* Yano
Cryptomeria japonica (L.) D. Don: *Megastigmus cryptomeriae* Yano

ENTOMOPHAGOUS SPECIES

(Alphabetical by Order, Family, Genus, Species)

The list given below presents published information on insect hosts to the lowest taxonomic level known. In some cases this is only the plant host that has been attacked by some unknown insect. Correct nomenclature and author's names for Cynipidae were provided by George Melika. *Torymus* names were verified in Graham and Gijswijt (1998). Hemiptera names were taken from ScaleNet (<http://www.sel.barc.usda.gov/scalenet/query.htm>). Plant names were checked as described in the section for Phytophagous species (above).

DIPTERA

Cecidomyiidae

Amradiplosis echinogalliperda see *Procontarinia echinogalliperda*
Fergusonina (flower galls on *Eucalyptus macrorhyncha*): *Megastigmus quinquesetae* (Girault)
Procontarinia echinogalliperda (Mani) (on *Mangifer indica*): *Mangostigmus amraeus* (Kurian)
 Unknown Diptera on:
Aster ramulosus (gall): *Megastigmus asteri* Ashmead
Helichrysum scorpioides (dipterous larvae): *Megastigmus tasmaniensis* Girault

HEMIPTERA

Ericoccidae

Apiomorpha crispa (Olliff): *Megastigmus iamenus* Walker
Apiomorpha pileata (Schrader) (gall): *Megastigmus iamenus* Walker
Apiomorpha strombylosa (Tepper): *Megastigmus brachyscelidis* Ashmead
Brachyscelis crispa see *Apiomorpha strombylosa*
Brachyscelis pileata see *Apiomorpha pileata*
Brachyscelis strombylosa see *Apiomorpha strombylosa*

HYMENOPTERA

Cynipidae

Andricus albopunctatus see *Andricus paradoxus*

- Andricus caputmedusae* (Hartig): *Megastigmus dorsalis* (Fabricius), *Megastigmus stigmatizans* (Fabricius)
- Andricus conglomeratus* (Giraud): *Megastigmus dorsalis* (Fabricius)
- Andricus coriarius* (Hartig): *Megastigmus dorsalis* (Fabricius), *Megastigmus stigmatizans* (Fabricius)
- Andricus corruptrix* (Schlechtendal): *Megastigmus dorsalis* (Fabricius)
- Andricus corticis* see *Andricus quercuscorticis*
- Andricus curvator* Hartig: *Megastigmus dorsalis* (Fabricius)
- Andricus cydoniae* Giraud: *Megastigmus dorsalis* (Fabricius)
- Andricus dentimitratus* (Rejto): *Megastigmus stigmatizans* (Fabricius)
- Andricus fecundator* (Hartig): *Megastigmus dorsalis* (Fabricius)
- Andricus gallaeinctoriae* (Olivier): *Megastigmus dorsalis* (Fabricius), *Megastigmus stigmatizans* (Fabricius)
- Andricus glandium* see *Callirhytis glandium*
- Andricus globuli* see *Andricus inflator*
- Andricus glomeratus* (Giraud): *Megastigmus dorsalis* (Fabricius)
- Andricus glutinosus* (Giraud): *Megastigmus dorsalis* (Fabricius), *Megastigmus stigmatizans* (Fabricius), *Megastigmus synophri* Mayr
- Andricus grossulariae* Giraud: *Megastigmus dorsalis* (Fabricius)
- Andricus inflator* (Hartig): *Megastigmus dorsalis* (Fabricius)
- Andricus kollari* (Hartig): *Megastigmus dorsalis* (Fabricius), *Megastigmus stigmatizans* (Fabricius)
- Andricus korlevici* (Kieffer): *Megastigmus dorsalis* (Fabricius)
- Andricus lignicolus* (Hartig): *Megastigmus dorsalis* (Fabricius)
- Andricus lucidus* (Hartig): *Megastigmus dorsalis* (Fabricius), *Megastigmus stigmatizans* (Fabricius)
- Andricus multiplicatus* Giraud: *Megastigmus dorsalis* (Fabricius)
- Andricus noduli* see *Andricus quercusradicis*
- Andricus paradoxus* (Radoskovsky): *Megastigmus dorsalis* (Fabricius)
- Andricus polycerus* (Giraud): *Megastigmus dorsalis* (Fabricius)
- Andricus quercuscorticis* (L.): *Megastigmus dorsalis* (Fabricius)
- Andricus quercusradicis* (Fabricius): *Megastigmus dorsalis* (Fabricius)
- Andricus quercusramuli* (L.): *Megastigmus dorsalis* (Fabricius)
- Andricus quercusramuli autumnalis* see *Andricus quercusramuli*
- Andricus quercusalicicis* (Burgsdorf): *Megastigmus stigmatizans* (Fabricius)
- Andricus quercustozae* (Bosc): *Megastigmus stigmatizans* (Fabricius)
- Andricus singularis* see *Andricus singulus*
- Andricus singulus* (Mayr): *Megastigmus dorsalis* (Fabricius)
- Andricus* sp.: *Megastigmus maculipennis* Yasumatsu and Kamijo, *Megastigmus nipponicus* Yasumatsu and Kamijo
- Andricus terminalis* see *Biorhiza pallida*
- Andricus testaceipes* Hartig: *Megastigmus dorsalis* (Fabricius)
- Andricus trilineatus* see *Andricus quercusradicis*
- Andricus viscosus* (Nieves Aldrey): *Megastigmus dorsalis* (Fabricius)
- Aphelonyx cerricola* (Giraud): *Megastigmus dorsalis* (Fabricius)
- Aphilothrix gemmae* see *Andricus fecundator*
- Aphilothrix lucida* see *Andricus lucidus*
- Biorhiza pallida* (Olivier): *Megastigmus dorsalis* (Fabricius)

- Biorhiza terminalis* see *Biorhiza pallida*
Biorhiza weldi Yasumatsu and Matsuda: *Megastigmus nipponicus* Yasumatsu and Kamijo
Callirhytis glandium (Giraud): *Megastigmus dorsalis* (Fabricius)
Cynips argentea see *Andricus quercustozae*
Cynips calicis see *Andricus quercusallicicis*
Cynips caput-medusae see *Andricus caputmedusae*
Cynips conglomerata see *Andricus conglomeratus*
Cynips coriaria see *Andricus coriarius*
Cynips divisa Hartig: *Megastigmus dorsalis* (Fabricius), *Megastigmus stigmatizans* (Fabricius)
Cynips folii see *Cynips quercusfolii*
Cynips glutinosa see *Andricus glutinosus*
Cynips glutinosa coronata see *Andricus glutinosus*
Cynips kollari see *Andricus kollari*
Cynips korlevici see *Andricus korlevici*
Cynips lignicola see *Andricus lignicolus*
Cynips longiventris Hartig: *Megastigmus dorsalis* (Fabricius)
Cynips malphighii see *Neuroterus quercusbaccarum*
Cynips mayri see *Andricus viscosus*
Cynips polycera see *Andricus polycerus*
Cynips quercusallicicis see *Andricus quercusallicicis*
Cynips quercusfolii L.: *Megastigmus dorsalis* (Fabricius)
Cynips tinctoriae see *Andricus gallaeinctoriae*
Dryocosmus kuriphilus Yasumatsu: *Megastigmus maculipennis* Yasumatsu and Kamijo,
 Megastigmus nipponicus Yasumatsu and Kamijo
Dryophanta macroptera see *Neuroterus macropterus*
Neuroterus macropterus (Hartig): *Megastigmus almusiensis* Doganlar, *Megastigmus dorsalis*
 (Fabricius)
Neuroterus numismalis (Olivier): *Megastigmus stigmatizans* (Fabricius)
Neuroterus quercusbaccarum (L.): *Megastigmus dorsalis* (Fabricius)
Neuroterus quercusbaccarum lenticularis see *Neuroterus quercusbaccarum*
Neuroterus saliens (Kollar): *Megastigmus dorsalis* (Fabricius)
Neuroterus sp.: *Megastigmus maculipennis* Yasumatsu and Kamijo
Plagiotrochus kiefferianus see *Plagiotrochus quercussilicis*
Plagiotrochus quercussilicis (Fabricius): *Megastigmus dorsalis* (Fabricius)
Spathegaster glandiformis see *Neuroterus saliens*
Synergus flavidornis see *Synergus pallicornis*
Synergus pallicornis Hartig: *Megastigmus dorsalis* (Fabricius)
Synophrus politus Hartig: *Megastigmus dorsalis* (Fabricius), *Megastigmus synophri* Mayr
Synergus reinhardi Mayr: *Megastigmus dorsalis* (Fabricius)
Synergus umbraculus (Olivier): *Megastigmus dorsalis* (Fabricius)
Unknown cynipid gall on *Quercus spicata*: *Megastigmus dorsalis* (Fabricius)

Eurytomidae

- Bruchophagus fellis* (Girault): *Bootanelleus nonvitta* (Girault), *Megastigmus brevipalpus*
 (Girault), *Megastigmus trisulcus* (Girault)
Eurytoma fellis see *Bruchophagus fellis*

Pteromalidae

Perilampella hecateus (Walker) (galls on *Acacia decurrens* (Wendl.) Willd.): *Megastigmus acaciae* Noble

Tepperella trilineata see *Perilampella hecateus*
Trichilogaster acaciaelongifoliae (Froggatt) (flower galls on *Acacia floribunda* (Vent.) Willd.):
Megastigmus darlingi (Girault)

Torymidae

Torymus auratus (Müller): *Megastigmus dorsalis* (Fabricius)
Torymus cingulatus Nees: *Megastigmus dorsalis* (Fabricius)
Torymus nigricornis see *Torymus auratus*

? THYSANOPTERA

gall (caused by ?thrips) on *Acacia pendula*: *Megastigmus limoni* (Girault)

HOST UNKNOWN

Below is a list of plants for which the specific insect host is unknown even to order, but in all cases the host is presumed to be an insect associated with the plant. Where information is available (e.g., bud gall) this is given in parentheses following the plant name. In some cases the site of the gall is not even known (i.e., buds, leaves, twigs). The list represents all known information about the host as reported in the literature.

Acacia implexa Benth. (gall): *Megastigmus mercatori* (Girault), *Megastigmus trisulcus* (Girault)
Acacia culacocarpa A. Cunn. (gall): *Megastigmus limoni* (Girault)
Banksia sp.: *Megastigmus banksiae* (Girault)
Brachychiton populneum (Schott & Endl.) R. Br. (gall): *Megastigmus brachychitonii* Froggatt
(fleshy twig galls), *Megastigmus grotius* Girault (gall), *Megastigmus sulcicollis* Cameron
(flower galls)
Calycopterys floribunda Lamark (bud galls): *Megastigmus viggianii* Narendran and Sureshan
Careya australis see *Planchonia careya*
Corymbia tessellaris (F. Muell.) K. D. Hill & L. A. S.: *Megastigmus fieldingi* Girault
Eucalyptus melanophloeia F. Muell. (bud galls): *Megastigmus herndoni*
Eucalyptus miniata A. Cunn.: *Megastigmus hilli* Dodd
Eucalyptus obliqua L. Her. (leaf galls): *Megastigmus aer* (Girault)
Eucalyptus sp. (gall): *Megastigmus eucalypti* Girault, *Megastigmus iamenus* Walker (globular gall)
Eucalyptus tessellaris see *Corymbia tessellaris*
Ficus mariannensis see *Ficus prolixa*
Ficus prolixa G. Forst.: *Megastigmus mariannensis* Fullaway
fig: *Megastigmus mariannensis* Fullaway
fig, Port Jackson: *Megastigmus maculatipennis* (Girault)
kurrajong tree see *Brachychiton populneum*
Hakea (bud gall): *Megastigmus ?melleus* Girault
Hakea dactyloides (Gaertn.) Cav. (bud-gall): *Bortesia longistigmus* (Riek), *Bortesia mirostigmus* (Riek)
Hakea leucoptera R. Br. ("pineapple bud-gall"): *Bortesia similis* (Riek)
Hakea teretifolia (bud gall): *Bortesia mirostigmus* (Riek)
host plant unknown (gall): *Boatanelleus aereus* (Girault), *Megastigmus adelaideensis* Girault,

- Megastigmus maculatipennis* (Girault), *Megastigmus trisulcatus* Girault
Microcitrus: *Bootanellus nymphae* (Girault)
Planchonia careya (F. Muell.) R. Knuth (gall): *Neomegastigmus lividus* Girault
Quercus semecarpifolia (cocoons on): *Megastigmus dorsalis* Fabricius
Trichagalma serratae: *Megastigmus habui* Kamijo
?*Tristania* (leaf galls): *Paramegastigmus flavus* (Girault)

INDEX TO HOST NAMES

- Abies* 56
Acacia 64
Albizia 56
Amelanchier 59
Amradiplosis (see *Procontarinia*)
Anacardiaceae 54
Andricus 62
Aphelonyx 62
Aphilothrix (see *Andricus*)
Apionomorpha 61
Aquifoliaceae 54
Aster 61
Asteraceae 54
bamboo shoots 59
Banksia 64
Biorhiza 62
Brachychiton 64
Brachyscelis (see *Apionomorpha*)
Bruchophagus 63
Callirhytis 63
Calycopterys 64
Careya (see *Planchonia*)
Casuarina 54
Casuarinaceae 54
Cecidomyiidae 61
Cedrus 57
Chamaecyparis 55
cocoons (on *Quercus*) 65
conifer seed 57
Corymbia 64
Cotoneaster 59
Crataegus 59
Cryptomeria 61
Cupressaceae 55
Cupressus 55
cynipid gall (on *Quercus*) 63
Cynipidae 61
Cynips 63
Dalbergia 56
Diptera 61
Distylium 56
Dryocosmus 63
Dryophanta (see *Neuroterus*)
Ericoccidae 61
Eucalyptus 64
Eucalyptus (see *Corymbia*)
Eurytoma (see *Bruchophagus*)
Eurytomidae 63
Fabaceae 56
Fergusonina 61
Ficus 64
fig, Port Jackson 64
Hakea 64
Hamamelidaceae 56
Heeria (see *Ozoroa* sp.)
Helianthus 54
Helichrysum 61
HEMIPTERA 61
HYMENOPTERA 61
Ilex 54
Juniperus 55
kurrajong tree (see *Brachychiton*)
Larix 57
Malus 59
Mangifer 61
Microcitrus 65
Milletia (see *Dalbergia*)
Neuroterus 63
Ozoroa 54
Pandanaceae 56
Pandanus 56
Perilampella 64
Photinia 61
Physocarpus 61
Picea 58
Pinaceae 56
Pinus 58
Pistacia 54
Plagiotrochus 63
Planchonia 65
Poaceae 59
Pourthiae (see *Photinia*)
Procontarinia 61
Pseudotsuga 59
Pteromalidae 64
Pyrus (see *Malus*)
Rhus 54
Rosa 59
Rosaceae 59
Sabina (see *Juniperus*)
Schinus 54
Sorbus 61
Spathegaster (see *Neuroterus*)
Synergus 63
Synophrus 63
Taxodiaceae 61
Tepperella (see *Perilampella*)
thrips gall 64
Thujopsis 56
THYSANOPTERA 64
Torymus 64
Trichagalma 65
Trichilogaster 64
Tristania (leaf galls) 65
Tsuga 59

LITERATURE CITED

- Agnostopoulos, P. T. 1938. [Pests of hazel, chestnut and pistachio]. *Dendrokronologia Eurena* 3: 497-544. [In Greek]
- Annila, E. 1970. Host trees and emergence of *Megastigmus specularis* Walley (Hym.: Torymidae). *Annales Entomologici Fennici* 36: 186-190.
- Ashmead, W. H. 1886. Studies on the North American Chalcididae, with descriptions of new species from Florida. *Transactions of the American Entomological Society* 13: 125-135.
- . 1887. Studies on the North American Chalcididae, with descriptions of new species, chiefly from Florida. *Transactions of the American Entomological Society* 14: 183-203.
- . 1888. Descriptions of some unknown parasitic Hymenoptera in the collection of the Kansas State Agricultural College, received from Prof. E. A. Popenoe. *Bulletin of the Kansas State Agricultural College* 3: i-viii.
- . 1890. On the Hymenoptera of Colorado; descriptions of new species, notes and a list of the species found in the state. *Bulletin of the Colorado Biological Association* 1: 1-47.
- . 1900. Notes on some New Zealand and Australian parasitic Hymenoptera, with descriptions of new genera and new species. *Proceedings of the Linnean Society of New South Wales* 25: 327-360.
- . 1904. Descriptions of new Hymenoptera from Japan.—II. *Journal of the New York Entomological Society* 12: 146-165, pl. 7, 8.
- . 1905. New genera and species of Hymenoptera from the Philippines. *Proceedings of the United States National Museum* 29: 397-413.
- Askew, R. R. 1961. On the biology of the inhabitants of oak galls of Cynipidae (Hymenoptera) in Britain. *Transactions of the Society for British Entomology* 14: 237-268.
- . 1966. Observations on the British species of *Megastigmus* Dalman (Hym., Torymidae) which inhabit cynipid oak galls. *The Entomologist* 1966: 124-127.
- Balduf, W. V. 1945. Bionomics of the rose seed chalcid, *Megastigmus nigrovariegatus* Ashm. (Hymenoptera, Callimomidae). *Proceedings of the Entomological Society of Washington* 47: 187-198.
- . 1957. Variations in *Megastigmus* from rose hips (Torymidae, Hymenoptera). *Annals of the Entomological Society of America* 50: 478-483.
- . 1959. Obligatory and facultative insects in rose hips, their recognition and bionomics. *Illinois Biological Monographs* 26: i-vi, 1-194.
- Baltazar, C. R. 1966. A catalogue of Philippine Hymenoptera (with a bibliography, 1758-1963). *Pacific Insects Monographs* 8: 1-488.

- Boheman, C. H. 1834. Skandinaviska Pteromaliner. *Kongliga Svenska Vetenskapsakademiens Handlingar* 54: 329-380.
- Borries, H. 1895. Iagttagelser over Danske Naaletrae-Insekter. *Tidsskrift for Skovvaesen* 7(B): 1-95.
- Bouček, Z. 1970a. On some new or otherwise interesting Torymidae, Ormyidae, Eurytomidae and Pteromalidae (Hymenoptera), mainly from the Mediterranean subregion. *Bollettino del Laboratorio Agraria "Filippo Silvestri" di Portici* 27: 27-54.
- _____. 1970b. On some British *Megastigmus* (Hym. Torymidae), with a revised key to the west European species. *Entomologist's Gazette* 21: 265-275.
- _____. 1971. A new species of *Megastigmus* (Hymenoptera, Torymidae) on rose seeds from Central Europe. *Entomologist's Gazette* 22: 43-46.
- _____. 1974. On the Chalcidoidea described by C. Rondani. *Redia* 55: 241-285.
- _____. 1977. A faunistic review of the Yugoslavian Chalcidoidea (Parasitic Hymenoptera). *Acta Entomologica Jugoslavica* 13 (Suppl.): 1-145.
- _____. 1978. A study of the non-podagrionine Torymidae with enlarged hind femora, with a key to the African genera. *Journal of the Entomological Society of Southern Africa* 41: 91-134.
- _____. 1982. Four new Mediterranean Torymidae. *Entomologist's Gazette* 33: 183-191.
- _____. 1986. Taxonomic study of chalcidoid wasps (Hymenoptera) associated with gall midges (Diptera: Cecidomyiidae) on mango trees. *Bulletin of Entomological Research* 76: 393-407.
- _____. 1988. *Australasian Chalcidoidea (Hymenoptera)*. Wallingford, UK: C. A. B. International. 832 pp.
- Breland, O. P. 1938. Phylogeny of some callimomid genera (parasitic Hymenoptera). *Journal of the New York Entomological Society* 46: 355-398.
- Cameron, P. 1905. On the phytophagous and parasitic Hymenoptera collected by Mr. E. Ernest Green in Ceylon. *Spolia Zeylanica* 3: 67-97.
- _____. 1909. On two new genera (one representing a new tribe) from Borneo. *Entomologist* 42: 209-211.
- _____. 1912. On a collection of parasitic Hymenoptera (chiefly bred) made by Mr W. W. Froggatt, F.L.S., in New South Wales, with descriptions of new genera and species. Part 2. *Proceedings of the Linnean Society of New South Wales* 36: 636-655.
- Carcreff, E., J. Y. Rasplus, A. Roques, G. Mondor, D. Vautrin, and M. Solignac. 1998. Isolation and characterization of microsatellite loci in the seed chalcid *Megastigmus wachtli* (Hymenoptera). *Molecular Ecology* 7: 251-253.

- Cibrian-Tober, D., B. H. Ebel, H. O. Yates, and J. T. Mendez-Montiel. 1986. Cone and seed insects of the Mexican conifers. *Technical Report of the United States Forest Service Southeast Forest Experiment Station SE-40: 1-110.* [In English and Spanish]
- Cibrian-Tober, D., J. T. Mendez-Montiel, B. C. Bolanos, H. O. Yates, and J. F. Lara. 1995. *Forest Insects of Mexico.* Chapingo, México: Universidad Autónoma Chapingo. 453 pp.
- Copeland, M. J. W., and P. E. King. 1972. The structure of the female reproductive system in the Torymidae (Hymenoptera: Chalcidoidea). *Transactions of the Royal Entomological Society of London* 124: 191-212.
- Crosby, C. R. 1909. On certain seed-infesting chalcis-flies. *Bulletin of the New York Agricultural Experiment Station, Ithaca* 265: 367-388.
- _____. 1913. A revision of the North American species of *Megastigmus* Dalman. *Annals of the Entomological Society of America* 6: 155-170.
- Currie, G. A. 1937. Galls on eucalyptus trees. A new type of association between flies and nematodes. *Proceedings of the Linnean Society of New South Wales* 62: 147-174.
- Cushman, R. A. 1918 [Dated 1917]. Two new chalcids from the seeds of *Amelanchier* [Hymenoptera]. *Proceedings of the Entomological Society of Washington* 19: 79-86.
- Dahlbom, A. G. 1857. Svenska Sma-Ichneumonernas familjer och slagten. *Kongliga Svenska Vetenskapsakademiens Handlingar* 14: 289-298.
- Dahms, E. C. 1978. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: I. Introduction, acknowledgments, biography, bibliography and localities. *Memoirs of the Queensland Museum* 19: 127-190.
- _____. 1983. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: II. Preamble and Chalcidoidea species A-E with advisory notes. *Memoirs of the Queensland Museum* 21: 1-255.
- _____. 1984. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: III. Chalcidoidea species F-M with advisory notes. *Memoirs of the Queensland Museum* 21: 579-842.
- _____. 1986. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: IV. Chalcidoidea species N-Z and genera with advisory notes plus addenda and corrigenda. *Memoirs of the Queensland Museum* 22: 319-739.
- Dalla Torre, C. G. de. 1897. Zur Nomenclatur der Chalcididen-Genera. *Wiener Entomologische Zeitung* 16: 83-88.
- _____. 1898. *Catalogus Hymenopterorum hueusque descriptorum systematicus. V. Chalcididae et Proctotrupidae.* Leipzig: 598 pp.

- Dalman, J. W. 1820. Forsok till Uppställning af Insekfamiljen Pteromalini, i synnerhet med afeende pa di i sverige funne arter. *Kongliga Svenska Vetenskapsakademiens Handlingar* 41: 123-174, 177-182, 340-385, pls. 7-8.
- Davatchi, G. A. 1958. Étude biologique de la faune entomologique des *Pistacia* sauvages et cultivés. *Revue de Pathologie Végétale et d'Entomologie de France* 37: 3-166.
- De Santis, L. 1989. Catálogo de los himenópteros chalcidoideos al sur de los Estados Unidos.-- Segundo suplemento. *Acta Entomológica Chilena* 15: 9-90.
- De Stefani, T. 1908. L'Insetto dei frutti de pistacchio e modo di limitarne i danni. *Istituto di Zoologia e Anatomia Comparata della R. Università, Palermo*. 61 pp.
- . 1917. *Megastigmus ballestrerii*, a hymenopteron living on pistacio tree and turpentine tree in Sicily. *Bulletino Studi Inform R. Giordano Coloniale di Palermo* 4: 101-131.
- Doane, R. W., E. C. van Dyke, W. J. Chamberlin, and H. E. Burke. 1936. *Forest insects*. New York: McGraw-Hill Book Co., Inc. 463 pp.
- Dodd, A. P. 1917. Records and descriptions of Australian Chalcidoidea. *Transactions of the Royal Society of South Australia* 41: 344-368.
- Doganlar, M. 1989. A new parasitic species of *Megastigmus* Dalman (Hymenoptera: Torymidae) from Tokat. *Turkiye Entomoloji Dergisi* 13: 197-203.
- Dolgin, M. M. 1993. [Biology of *Megastigmus bipunctatus* Swed. (Hymenoptera, Torymidae) in Komi Republic]. *Entomologicheskoe Obozrenie* 72: 543-548. [In Russian; also, *Entomological Review* 73(2):30-35, in English.]
- Domenichini, G. 1953. Studio sulla morfologia dell'addome degli Hymenoptera Chalcidoidea. *Bollettino di Zoologia Agraria e Bachicoltura* 19: 183-298, + pl. 1.
- Dowden, P. B. 1950. Suborder Clistogastra or Aprorita: Bees, wasps, ants, and parasites, pp. 591-637. Ed. F. C. Craighead, *Insect enemies of Eastern Forests*, Washington, D.C.: U. S. Department of Agriculture Miscellaneous Publication No. 657, United States Government Printing Office, 669 pp.
- Erdös, J. 1960. Hymenoptera II. Femfurkeszek II. Chalcidoidea II. *Fauna Hungarica* 12: 1-230. [In Hungarian]
- Escherich, K. 1938. Die phytophagen *Megastigmus*-Arten (Chalcididae) als Zerstörer von Nadelholzamen. *Zeitschrift für Angewandte Entomologie* 35: 363-380.
- Fabre, J. P. 1986. Dynamique des populations de *Megastigmus suspectus* var. *pinsapīnis* Hoff. (Hym. Torymidae) dans les cédraires du Sud-Est de la France. pp. 127-145. In A. Roques (ed.), *Second International Conference, Cone and Seed Insects Working Party*, Briancon, Versailles, INRA.

- Fabre, J. P., C. U. Halpetkin, and A. Chalon. 1994. Importance des attaques des graines de Cedre du Liban, *Cedrus libani*, en Turquie par *Megastigmus schimitscheki* (Hym. Torymidae) et reique d'extension de cet insecte au Cedre de l'Atlas, *Cedrus libani*. *Annales de la Recherche Forestiere au Maroc* 27: 566-575.
- Fabricius, J. C. 1798. *Supplementum Entomologiae Systematicae*. Copenhagen: Profit and Storch. 572 pp.
- _____. 1804. *Systema Piezatorum*. Brunswick: Carolum Reichard. 439 pp.
- Fahringer, J. 1922. Beitrage zur Kenntnis der Lebensweise einiger Chalcididen (parts 1, 2). *Zeitschrift für Wissenschaftliche Insektenbiologie* 17: 7-13, 41-46.
- Farooqi, S. I. 1985. Torymidae, pp. 268-272. In B. R. Subba Rao and M. Hayat, eds., The Chalcidoidea (Insecta, Hymenoptera) of India and the adjacent countries. Pt. I. Review of families and keys to families and genera. *Oriental Insects* 19: 161-310 (+ pp. A-O).
- _____. 1986. Family Torymidae, pp. 259-277. In B. R. Subba Rao and M. Hayat, eds., The Chalcidoidea (Insecta, Hymenoptera) of India and the adjacent countries. Pt. II. A Catalogue. *Oriental Insects* 20: 1-430.
- Ferrière, C. 1929. Chalcidiens gallois de Java. *Annales de la Société Entomologique de France* 98: 143-161.
- Förster, A. 1840. *Beitrag zur Monographie der Pteromalinen Nees. Heft 1*. Aachen: Jacob Anton Maher. 46 pp., 1 pl (dated 1841, published 1840 accord. to Griffin, 1931).
- _____. 1859. Zweite centurie neuer hymenopteren. *Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens* 16: 87-124.
- Froggatt, W. W. 1905. The insects of the Kurrajong (*Brachychiton populneum*). *Agricultural Gazette of New South Wales* 16: 226-234.
- _____. 1907. *Australian insects*. Sydney, Australia: William Brooks & Company, Ltd., 449 pp.
- Fullaway, D. T. 1946. Insects of Guam-II. Hymenoptera, new species of Guam Chalcidoidea. Ichneumonidae, Evanidae and Braconidae of Guam. *Bernice P. Bishop Museum Bulletin* 189: 157-162, 201-210.
- Furth, D. G. 1985. The natural history of a sumac tree, with an emphasis on the entomofauna. *Transactions of the Connecticut Academy of Arts and Sciences* 46: 137-234.
- Gahan, A. B. 1922. A list of phytophagous Chalcidoidea with descriptions of two new species. *Proceedings of the Entomological Society of Washington* 24: 33-61.
- George, W. 1962. *Animal Geography*. London, England: Heinemann Educational Books Ltd. 142 pp.

- Gibson, F. A. and J. G. Gellatley. 1968. *Epimegastigmus brevivalvus* Gir. (Hymenoptera: Torymidae), a parasite of citrus gall wasp in the Sydney district. *Agricultural Gazette of New South Wales* 79: 312-314.
- Girault, A. 1913/148. Some new Australian genera in the hymenopterous families Eurytomidae, Perilampidae, Eucharitidae and Cleonymidae. *The Canadian Entomologist* 45: 220-228.
- Girault, A. A. 1913/175. New genera and species of chalcidoid Hymenoptera in the South Australian Museum. *Transactions of the Royal Society of South Australia* 37: 67-115.
- _____. 1914/176. A new megastigmid from Queensland, Australia. *Entomological News* 25: 25.
- _____. 1915/234. Some chalcidoid Hymenoptera from North Queensland. *The Canadian Entomologist* 47: 42-48.
- _____. 1915/243. Australian Hymenoptera Chalcidoidea--XII. *Memoirs of the Queensland Museum* 4: 275-309.
- _____. 1925/391. New Queensland Insecta captured without any reference to use. Privately printed. 2 pp.
- _____. 1926/393. Characteristics of new Australian insects. (Refused publication on pretext). Privately printed. 2 pp.
- _____. 1926/398. New pests from Australia. II. Privately printed. 3 pp.
- _____. 1927/416. Notes on descriptions of chalcid wasps (Chalcididae) in the South Australian Museum. *Records of the South Australian Museum* 3: 309-338.
- _____. 1928/420. Australian chalcid-wasps. *Victorian Naturalist* 44: 261-263.
- _____. 1928/421. A prodigious discourse on wild animals. Privately printed. 3pp.
- _____. 1928/425. Some new Philippine chalcid flies. *Philippine Journal of Science* 36: 449-453.
- _____. 1929/431. Notes on, and descriptions of, chalcid wasps in the South Australian Museum. Concluding paper. *Transactions of the Royal Society of South Australia* 53: 309-346.
- _____. 1933/440. Some beauties inhabitant not of commercial boudoirs but of nature's bosom—new insects. Privately printed. 5 pp.
- _____. 1934/443. Miridae et Hymenoptera nova Australiensis. Privately printed. 3 pp.
- _____. 1934/444. New Capsidae and Hymenoptera, with note on an unmentionable. Privately printed. 4 pp.
- _____. 1935/445. Microhymenoptera Australiensis nova, mostly Chalcididae. Privately printed. 4 pp.

- _____. 1937/448. New naturals, unorthodoxies and non-pollutions, viz. new hexapods. Privately printed. 3 p.
- _____. 1938/450. Some new Australasian insects which are parasites (Hym. Chalcidoidea). *Revista de Entomología Rio de Janeiro* 8: 80-89.
- _____. 1939/455. A giant from New Guinea. *Verhandlungen VII. Internationaler Kongress für Entomologie* 1: 147-150.
- _____. 1940/460. Three new Chalcidoidea from Australia. *Queensland Naturalist* 11: 103-109.
25. Götsche, von A.-B. 1976. Stimmungsbedingte Gelbpräferenz beim Orentierungsverhalten adulter *Megastigmus bipunctatus* Swederus (Hym., Chalc., Torymidae). *Zeitschrift für Angewandte Entomologie* 82: 210-215.
- _____. 1977. Verhalten von *Megastigmus bipunctatus* (Hymenoptera, Chalcididae) bei der Wirts- und Nahrungssuche. *Entomologica Experimentalis et Applicata* 22: 90-106.
- Gourlay, E. S. 1930. Some parasitic Hymenoptera of economic importance in New Zealand. *New Zealand Journal of Science and Technology* (339-343):
- Graham, M. W. R. 1969. Some Torymidae (Hymenoptera: Chalcidoidea) new to Britain, with notes on other British species. *Proceedings of the Royal Entomological Society of London* 38: 61-69.
- _____. 1988. The remains of Nees von Esenbeck's collection of Hymenoptera in the University Museum, Oxford. *The Entomologist's Monthly Magazine* 124: 19-35.
- _____. 1990. The identity of certain problematic Dahlbom genera of Chalcidoidea (Hym.), some represented by original material in Zoologiska Institutionen, Lund. *The Entomologist's Monthly Magazine* 126: 197-200.
- Graham, M. W. R. de, and M. J. Gijswijt. 1998. Revision of the European species of *Torymus* Dalman (s. lat.) (Hymenoptera: Torymidae). *Zoologische Verhandelingen* 317:1-202.
- Grissell, E. E. 1979. Torymidae, pp. 748-769. *Catalog of Hymenoptera in America North of Mexico. Vol. I. Symphyta and Apocrita*, in K. V. Krombein, P. D. Hurd, D. R. Smith, and B. D. Burks eds. Washington, D.C.: Smithsonian Institution Press. 1198 pp.
- _____. 1989a. *Megastigmus floridanus* (Hymenoptera: Torymidae), newly discovered in *Ilex* seed (Araliaceae). *Proceedings of the Entomological Society of Washington* 91: 604-610.
- _____. 1989b. Discovery of a holly seed-feeding wasp. *Holly Society Journal* 7 (4): 3-9.
- _____. 1995. Toryminae (Hymenoptera: Chalcidoidea: Toryminae): a redefinition, generic classification, and annotated world catalog of species. *Memoirs on Entomology, International* 2: 1-470.

- Grissell, E. E. and S. L. Heydon. 1999. The identity of two unplaced Megastigminae (Hymenoptera: Torymidae). *Proceedings of the Entomological Society of Washington* 101:611-613.
- Habeck, D. H., F. D. Bennett, and E. E. Grissell. 1989. First record of a phytophagous seed chalcid from Brazilian peppertree in Florida. *Florida Entomologist* 72: 378-379.
- Hansson, C. 1991. A Catalogue of the Chalcidoidea (Hymenoptera) described by C. G. Thomson, with a checklist of Swedish species. *Entomologica Scandinavica (Suppliment)* 38: 1-70.
- Harper, R. W., and S. Lockwood. 1961. Bureau of Entomology miscellaneous survey—detection finds. *Bulletin of the California Department of Agriculture* 50: 126-136.
- He, J. H. 1984. [A new pest of *Cryptomeria fortunei* Hooibrenk—*Megastigmus cryptomeriae* Yano]. *Forest Pest Disease* 4: 11-13. [In Chinese]
- Hedlin, A. F., H. O. Yates III, D. Cibrian-Tovar, B. H. Ebel, T. W. Koerber, and E. P. Merkel. 1980. *Cone and seed insects of North American conifers*. Ottawa: Environment Canada/Canadian Forestry Service; Washington: US Forest Service; Mexico: Secretaría de Agricultura y Recursos Hidráulicos, 122 pp.
- Hoffmeyer, E. B. 1929. Aus Samen gezuchte Callimomiden. *Entomologiske Meddelelser* 16: 323-334.
- _____. 1930. Notes on some North American Callimomidae (Hym. Chalc.). *Entomologiske Meddelelser* 17: 213-218.
- _____. 1931. Beiträge zur Kenntnis der dänischen Callimomiden, mit Bestimmungstabellen der europäischen Arten (Hym. Chalc.). *Entomologiske Meddelelser* 17: 261-285.
- Hussey, N. W. 1954. Revised descriptions of three *Megastigmus* species (Hym., Torymidae) associated with seeds of silver fir. *The Entomologist's Monthly Magazine* 90: 223-225.
- _____. 1955. The life histories of *Megastigmus spermotrophus* Wachtl (Hymenoptera: Chalcidoidea) and its principal parasite, with descriptions of the developmental stages. *Transactions of the Royal Entomological Society of London* 106: 133-151.
- _____. 1956a. A new genus of African Megastigminae (Hymenoptera: Chalcidoidea). *Proceedings of the Royal Entomological Society of London* 25: 157-162.
- _____. 1956b. A new species of *Megastigmus* (Hym.: Chalcidoidea) from British Somaliland. *Bulletin of Entomological Research* 47: 57-59.
- _____. 1957. *Megastigmus* species (Hym., Torymidae) associated with seeds of silver fir and cedar. *The Entomologist's Monthly Magazine* 93: 252-253.
- _____. 1962. Notes on the *Megastigmus* spp. (Hym., Torymidae) associated with seeds of *Larix* spp. *The Entomologist's Monthly Magazine* 98: 39-41.

- Hussey, N. W., and K. Kamijo. 1958. A new species of *Megastigmus* from Japan (Hym., Chalcidoidea). *Insecta Matsumurana* 21: 115-117.
- Hussey, N. W., and J. Klingler. 1954. Variation in *Megastigmus pinus* Parfitt (Hym., Chalcidoidea, Torymidae). *The Entomologist's Monthly Magazine* 40: 198-201.
- Huxley, A., M. Griffiths, and M. Levy. 1992. *The New Royal Horticultural Society Dictionary of Gardening*. New York, NY: The Stockton Press, 3200 pp.
- Jarraya, A., and J. Bernard. 1971. Premières observations bioécologiques sur *Megastigmus pistaciae* en Tunisie. *Annales de l'Institut National de la Recherche Agronomique le Tunisie* 44: 1-28.
- Jespersen, C., and O. Lomholdt. 1983. [The Danish species of *Megastigmus* Dalman, 1820 (Hymenoptera, Chalcidoidea, Torymidae).] *Entomologiske Meddelelser* 50: 111-118. [In Danish]
- Kamijo, K. 1958. Descriptions of two new species of *Megastigmus* from Japan (Hym., Chalcidoidea). *Insecta Matsumurana* 22: 31-34.
- _____. 1962. A revision of the species of the Megastigminae occurring in Japan (Hymenoptera: Chalcidoidea) [Taxonomic studies on the Torymidae of Japan, 1]. *Insecta Matsumurana* 25: 18-40.
- _____. 1979. Four new species of Torymidae from Japan, with notes on two known species. *Akitu (New Series)* 24: 1-11.
- _____. 1981. Description of the males and other notes on *Macrodasyces hirsutum*. *Akitu (N. S.)* 38: 1-4.
- Kangas, E. 1945. Eine neue *Megastigmus*-Art (Hym., Chalcididae) als Samenschadling an *Abies sibirica*. *Annales Entomologici Fennici* 11: 177-184.
- Kapuscinski, S. 1946. [*Megastigmus kuntzei* n. sp. (Hymenoptera, Chalcididae) destructive insect feeding on seeds of common junipers (*Juniperus communis* L.)]. *Rozprawy Instytutu Badawczego Lesnictwa Series A* 47: 1-105 [In Polish; the original 1946 publication was revised, updated, and reprinted in English in 1964; published by the U. S. Department of Agriculture, Office of Technical Services, Washington, D.C.]
- Karnowski, W. 1988. [*Megastigmus* Dalman—a quarantine pest of seeds of forest trees]. *Sbornik Ustav Vedekotechnickych Informaci Ochrana Rostlin* 32(11-12): 21-23. [In Polish]
- Keen, F. P. 1938. Insect enemies of western forests. *United States Department of Agriculture Miscellaneous Publication* 273: 1-209.
- _____. 1958. Cone and Seed Insects of Western Forest Trees. *United States Department of Agriculture, Technical Bulletin No. 1169*: i-vi, 1-168.

- Kieffer, J. J. 1905. Étude sur de nouveaux insectes et phytopptides gallois du Bengale. *Annales de la Société Scientifique de Bruxelles* 29: 143-200, pl. 2.
- Kieffer, J. J., and P. Jorgensen. 1910. Gallen und Gallentiere aus Argentinien. *Zentralblatt für Bakteriologie, Parasitendunde und Infektionskrankheiten Abt. 2* 27: 362-444.
- Kinzer, H. G., R. J. Ridgill, and J. G. Watts. 1972. Seed and cone insects of Ponderosa pine. *New Mexico State University, Agricultural Experiment Station Bulletin* 594: 1-29.
- Kurian, C. 1953. Description of a new chalcid parasite of midge of echinate gall of mango leaf. *Agra University Journal of Research (Science)* 2: 241-246.
- Laidlaw, W. B. R. 1931. *Megastigmus* in Scotland; with an addition to the Scottish list. *Scottish Forestry Journal* 45: 177-193.
- Lessmann, D. 1962. Übersicht der bisher bekannten *Megastigmus*-Arten und ihrer Wirtspflanzen. *Zeitschrift für Angewandte Entomologie* 50: 233-238.
- MacDougall, R. S. 1906a. *Megastigmus spermotrophus* Wachtl, as an enemy of Douglas fir (*Pseudotsuga Douglasii*). *Transactions of the Royal Scottish Arboricultural Society* 19: 52-65
- . 1906b. A new enemy of the Douglas fir. *Journal of the Board of Agriculture of London* 12: 615-621.
- Mani, M. S. 1938. *Catalogue of Indian insects. Part 23 -- Chalcidoidea*. Delhi: Government of India. 174 pp.
- . 1989. *The fauna of India and adjacent countries. Chalcidoidea (Hymenoptera). Pt. I and II*. Madras, India: Zoological Survey of India. 1633 pp.
- Mani, M. S., and B. K. Kaul. 1972. Some Torymidae (Hymenoptera: Chalcidoidea) from India. *Oriental Insects* 6: 313-331.
- Marcovitch, S. 1914. A species of *Megastigmus* reared from larch seeds. *The Canadian Entomologist* 46: 435-438.
- Masi, L. 1934. Nota sur Calcididi dell'Isola di Rodi. *Bollettino della Società Entomologica Italiana* 66: 210.
- Mathur, R. N. 1955. A new species of *Megastigmus* Dalman (Hymenoptera: Chalcidoidea) from seeds of *Cupressus torulosa* Don. *Proceedings of the Royal Entomological Society of London* 24: 91-94.
- Mathur, R. N., and N. W. Hussey. 1956. A new species of *Bootanomyia* (Chalcidoidea: Torymidae, Megastigminae) from India. *Indian Forest Bulletin (New Series)* 212: 1-3, 1 pl.
- Mayr, G. 1874. Die europäischen Torymiden. *Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft, Wien* 24: 53-142.

- Miller, J. M. 1916. Oviposition of *Megastigmus spermotrophus* in the seed of douglas fir. *Journal of Agricultural Research* 6: 65-68.
- Milliron, H. E. 1949. Taxonomic and biological investigations in the genus *Megastigmus* with particular reference to the taxonomy of the Nearctic species (Hymenoptera: Chalcidoidea: Callimomidae). *American Midland Naturalist* 41: 257-420.
- . 1950. Descriptions of some species of the genus *Pulvilligera* Strand from the South and Southwest Pacific (Hymenoptera: Chalcidoidea: Torymidae). *Pacific Science* 4: 346-354.
- Mukerji, S. 1950. On a new species of phytophagous Chalcidoidea *Megastigmus albizziae* sp. n., feeding on *Albizzia odoratissima* pods in the environs of Delhi. *Proceedings of the Royal Entomological Society of London* 19: 129-132.
- Murakami, Y., H.-B. Ao, and C.-H. Chang. 1980. Natural enemies of the chestnut gall wasp in Hopei Province, China (Hymenoptera: Chalcidoidea). *Applied Entomology and Zoology* 15: 184-186.
- Narendran, T. C. 1994. *Torymidae and Eurytomidae of Indian subcontinent*. Feroke, India: Printex. 500 pp.
- Narendran, T. C., and P. M. Sureshan. 1988. A contribution to our knowledge of Torymidae of India (Hymenoptera: Chalcidoidea). *Bollettino del Laboratorio di Entomologia Agraria "Filippo Silvestri" di Portici* 45: 37-47.
- Nees ab Esenbeck, C. G. 1834. *Hymenopterorum Ichneumonibus affinium monographiae, genera Europeaea et species illustrantes. Vol. 2.* Stuttgart and Tubingen: J. G. Cottae. 448 pp.
- Nikol'skaya, M. N. 1935. [Pistacia seed-eating chalcidids and their parasites (Hymenoptera, Chalcididae)]. *Plant Protection, Leningrad* 1935: 81-87. [In Russian]
- . 1952. *The chalcid fauna of the USSR*. Jerusalem: S. Monson. 593 pp. [Translated from the Russian by the Israel Program for Scientific Translation 1963]
- . 1966a. [A new species of *Megastigmus* Dalm. (Hymenoptera, Torymidae) reared from seeds of *Juniperus semiglobosa* Rgl.] *Entomologicheskoe Obozrenie* 45: 411 [In Russian; also in *Entomological Review* 45:223, in English]
- . 1966b. [Species of the genus *Megastigmus* Dalm. (Hymenoptera, Torymidae) from the seeds of *Juniperus*]. *Entomologicheskoe Obozrenie* 45: 857-859 [In Russian; also in *Entomological Review* 45:481-482, in English]
- Nikol'skaya, M. N., and M. D. Zerova. 1978. Family Torymidae (Callimomidae) (Torymids), pp. 651-685. *Keys to the Insects of the European part of the USSR, Vol. 3, Part 2*, G. S. Medvedev ed. New Delhi: [Translated from the Russian by Amerind Published Co., 1987] 1341 pp.

- Niwa, C. G., and D. L. Overhulser. 1992. Oviposition and development of *Megastigmus spermotrophus* (Hymenoptera:Torymidae) in unfertilized Douglas-fir seed. *Journal of Economic Entomology* 85: 2323-2328.
- Noble, N. S. 1933. The citrus gall wasp. *Agricultural Gazette of New South Wales* 1933: 465-469.
- _____. 1935. *Epimegastigmus brevivalvus* Girault, a parasite of the citrus gall wasp, *Eurytoma fellis* Girault. *The Journal of the Australian Institute of Agricultural Science* 1 (1): 29.
- _____. 1936. The citrus gall wasp (*Eurytoma fellis* Girault). *Science Bulletin of the Department of Agriculture, New South Wales* 53: 1-41.
- _____. 1938a. *Epimegastigmus (Megastigmus) brevivalvus* Girault: a parasite of the citrus gall wasp (*Eurytoma fellis* (Girault)); with notes on several other species of hymenopterous gall inhabitants. *Science Bulletin of the Department of Agriculture, New South Wales* 65: 1-46.
- _____. 1938b. *Tepperella trilineata* Cam., a wasp causing galling of the flower buds of *Acacia decurrens*. *Proceedings of the Linnean Society of New South Wales* 64: 389-411, pl. 20.
- _____. 1939a. A new species of chalcid (genus *Eurytoma*) associated with *Tepperella trilineata* Cam., a wasp causing galling of the flower buds of *Acacia decurrens*. *Proceedings of the Linnean Society of New South Wales* 64: 223-241.
- _____. 1939b. A new species of *Megastigmus* parasitic on *Tepperella trilineata* Cam., a wasp causing galling of the flower buds of *Acacia decurrens*. *Proceedings of the Linnean Society of New South Wales* 64: 266-278.
- _____. 1940. *Trichilogaster acaciae-longifoliae* (Frogatt) (Hymenopt., Chalcidoidea), a wasp causing galling of the flower-buds of *Acacia longifolia* Willd., *A. floribunda* Sieber and *A. sophorae* R. Br. *The Transactions of the Royal Entomological Society of London* 90: 13-38, pl. 1-2.
- Novitzky, S. 1954. Beitrage zur Kenntnis der Nadelholz-Samenzerstorer. I. Zedernsamenschalcidier—*Megastigmus schimitscheki* nov. spec. *Zeitschrift für Angewandte Entomologie* 36: 218-224.
- Noyes, J. S., and E. W. Valentine. 1989. Chalcidoidea (Insecta: Hymenoptera) -introduction, and review of genera in smaller families. *Fauna of New Zealand* 18: 1-91.
- Nuroteva, M. 1967. Über die zwei *Megastigmus*-arten (Hym., Torymidae) der Wacholdersamen (*Juniperus communis* L.). *Annales Entomologici Fennici* 33: 121-124.
- Pagliano, G., and P. Scaramozzino. 1990. Elenco dei generi di Hymenoptera del mondo. *Supplemento al Bollettino della Società Entomologica Italiana* 122: 1-210.
- Paik, J. C. 1978. A list of Chalcidoidea, Hymenoptera, from Korea. *The Korean Journal of Plant Protection* 17: 167-185.

- Parfitt, E. 1857a. Description of a new Hymenopterous insect, found amongst seeds of various species of *Pinus* from California. *Zoologist* 15: 5543-5544, 5629-5630.
- _____. 1857b. Description of the male of *Megastigmus pinus*.. *Zoologist* 15:5721.
- Parker, H. L. 1924. Recherches sur les formes postembryonnaires des chalcidiens. *Annales de la Société Entomologique de France* 93: 261-379, 39 pls.
- Peck, O. 1963. A catalogue of the Nearctic Chalcidoidea. *The Canadian Entomologist Supplement* 30: 1-1092.
- Perris, M. E. 1876. Nouvelles promenades entomologiques. *Annales de la Société Entomologique de France* 5: 171-244.
- Pintureau, B., J. P. Fabre, and M. L. Oliveira. 1991. Étude de deux formes de *Megastigmus suspectus* Borries. *Bulletin de la Société Entomologique de France* 95: 277-289.
- Poole, R. W., and P. Gentili. 1996. *Nomina Insecta Nearctica. Volume 2: Hymenoptera, Mecoptera, Megaloptera, Neuroptera, Raphidioptera, Trichoptera*. Rockville, MD.: Entomological Information Services, 793 pp.
- Ramakrishna Ayyar, T. V. 1920. On the insect parasites of some Indian crop-pests. *Report of the Proceedings of the Third Entomological Meeting (Pusa)* 1919 3: 931-936.
- Rappaport, N., S. Mori, and A. Roques. 1993. Estimating impact of a seed chalcid, *Megastigmus spermotrophus* Wachtl (Hymenoptera:Torymidae) on Douglas-fir seed production: The new paradigm. *Journal of Economic Entomology* 86: 845-849.
- Ratzeburg, J. T. C. 1848. *Die Ichneumonen der Forstinsecten in entomologischer und forstlicher Beziehung*. Vol. 2. Berlin: 238 pp., 4 tables, 3 pls.
- _____. 1852. *Die Ichneumonen der Forstinsecten in entomologischer und forstlicher Beziehung*. Vol. 3. Berlin: 272 pp., 3 tables.
- Rice, R. E., and T. J. Michailides. 1988. Pistachio seed chalcid, *Megastigmus pistaciae* Walker (Hymenoptera: Toymidae), in California. *Journal of Economic Entomology* 81: 1446-1449.
- Riek, E. F. 1966. A new genus of gall forming megastigmine Torymidae (Hymenoptera: Chalcidoidea). *Australian Journal of Zoology* 14: 1199-1206.
- _____. 1970. Chalcidoidea, pp. 913-924. *The Insects of Australia*, CSIRO ed. Carlton, Victoria: Melbourne University Press. 1029 pp.
- Robinson, D. W. 1968. California Department of Agriculture Pistachio seed chalcid progress report. 68-1. 2 pp.
- Rodzianko, W. N. 1908. [Ad cognitionen Torymidarum symbolae]. *Bulletin de la Société Imperiale des Naturalistes de Moscou* 1907: 592-612. [In Russian]

- Rohwer, S. A. 1915. Description of a new seed chalcid from spruce. *The Canadian Entomologist* 47: 97-98.
- Rondani, C. 1877. Vesparia parasita non vel minus cognita. *Bollettino della Società Entomologica Italiana* 9: 166-213.
- Roques, A. 1981. Biologie et répartition de *Megastigmus spermotrophus* Wachtl. et des autres insectes liés aux cônes dans les peuplements forestiers et vergers à graines français de sapin de Douglas *Pseudotsuga menziesii* (Mirb.) Franco. *Acta Oecologica/Oecologia Applicata* 2: 161-180.
- Roques, A. (Editor). 1983. *Les insectes ravageurs des cônes et graines de conifères en France*. Versailles: INRA. 135 pp.
- Roques, A., and J. P. Raimbault. 1986. Cycle biologique et répartition de *Megastigmus wachtli* (Seitn.) (Hymenoptera, Torymidae), chalcidien ravageur des graines de Cyprès dans le bassin méditerranéen. *Zeitschrift für Angewandte Entomologie* 101: 370-381.
- Roques, A., E. Carcreff, and J. Y. Rasplus. 1998. *Cupressus sempervirens* vs. Cypress seed chalcid, *Megastigmus wachtli*: genetic and evolutionary relationships. IUFRO S7.01 Symposium *Physiology and genetics of tree-phytophage interactions*, Versailles: INRA.
- Roques, A., Jiang-Hua Sun, Yong-Zhi Pan, and Xu-Dong Zhang. 1995. Contribution to the knowledge of seed chalcids, *Megastigmus* spp. (Hymenoptera: Torymidae), in China, with the description of three new species. *Bulletin de la Société Entomologique Suisse* 68: 211-223.
- Roques, A., J. P. Raimbault, and F. Goussard. 1984. La colonisation des cônes et galbules de genévrier méditerranéens par les insectes et acariens et son influence sur les possibilités de régénération naturelle de ces essences. *Ecologia Mediterranea* 10: 147-169.
- Roques, A., and M. Skrzypczynsky. (In prep.) Seed-infesting chalcids of the genus *Megastigmus* Dalman (Hymenoptera: Torymidae) native and introduced to Europe: taxonomy, host specificity and distribution. [Submitted to Journal of Natural History, May 1999.]
- Rye, E. C. 1874. Insecta. Hymenoptera. *Zoological Record* 11: 239-289.
- Schefer-Immell, V. 1957. Eine neue *Megastigmus*-Art, *Megastigmus zwölferi* nov. spec. (Hymenoptera, Chalcididae) als Samenstorer von *Pinus strobus*. *Zeitschrift für Angewandte Entomologie* 41: 52-57.
- Schimitschek, E. 1944 (Ed.). *Die Forstinsekten der Türkei*. Prague: Volk und Reich, 371 pp.
- Schmiedeknecht, O. 1909. *Genera insectorum. Hymenoptera fam. Chalcididae Fas. 97*. Brussels: M. P. Wytsman. 550 pp., 8 pl.
- Schulz, W. A. 1906. *Spolia Hymenopterologica*. Paderborn: Albert Pape. 357 pp.

- Scurlock, J. H., R. G. Mitchell, and K. K. Ching. 1982. Insects and other factors affecting noble fir seed production at two sites in Oregon. *Northwest Science* 56: 101-107.
- Seitner, M. 1916. Über Nadelholzsamen Zerstorende Chalcididen. *Centralblatt für Forstwesen* 42: 307-324.
- Sellenschlo, U. 1983a. Morphologie der Torymidae Imagines. *Neue Entomologische Nachrichten* 4: 19-23.
- _____. 1983b. Die Larven der Torymidae—einer nicht ganz seltenen Gruppe der Erzwespen. *Neue Entomologische Nachrichten* 4: 24-28.
- _____. 1984a. Biologie und Ökologie der Torymidae (Chalcidoidea, Hymenoptera), pp. 71-100. In, U. Sellenschol and I. Wall eds., *Die Erzwespen Mitteleuropas, System, Biologie und Bibliographie der Torymidae und Ormyridae*. Keltern: Erich Bauer. 111 pp.
- _____. 1984b. Torymidae-Studien in der Provence (Chalcidoidea, Hymenoptera), pp. 101-111. In, U. Sellenschol and I. Wall eds., *Die Erzwespen Mitteleuropas, System, Biologie und Bibliographie der Torymidae und Ormyridae*. Keltern: Erich Bauer. 111 pp.
- _____. 1984c. Makroskopische Erkennungsmerkmale und deren biologische Bedeutung bei Torymidae-Larven. *Entomologischen Mitteilungen aus dem Zoologischen Museum Hamburg* 7: 457-464.
- _____. 1989. Kopfdrusen bei Erzwespenlarven—Schutzeinrichtungen gegen Mikroorganismen. *Mikroskosos* 78: 146-148.
- Sheng, J. H. 1989. [Chalcids of Jiangxi Province]. Jiangxi: Publishing House of Jiangxi, Agricultural University. 343 pp. [In Chinese]
- Skrzypczynska, M. 1973. Zwei parasitenarten (Hym., Chalc., Eupelmidae und Pteromalidae von *Megastigmus pictus* (Föst.) (Hym., Chalc., Torymidae) in Lärchensamen. *Sonderdruck aus Anzeiger für Schädlingskunde, Pflanzen- und Umweltschutz* XLVI (4): 60-61.
- _____. 1978. *Megastigmus suspectus* Borries, 1895 (Hymenoptera, Torymidae), its morphology, biology and economic significance. *Zeitschrift für Angewandte Entomologie* 85: 204-215.
- _____. 1981. Males of *Megastigmus pictus* (Forster) in Poland. *Polskie Pismo Entomologiczne* 51: 207-208.
- _____. 1996. [Fruit- and seminiphagous insects of rowan-tree *Sorbus aucuparia* L. in the selected localities of the Ojcow National Park in 1994-1995]. *Acta Agraria et Silvestria, Series Silvestris* 34: 93-104. [In Polish]
- Smith, J. C. 1855. *Harper's Statistical Gazetteer of the World*. New York, NY: Harper & Brothers. 1952 pp.

- Stadnitskii, G. V., G. I. Jurchenko, A. N. Smetanin, V. P. Grebenshchikova, and M. V. Pribylova. 1978. *Vrediteli shishek i semian svoinykh porod [Conifer cone and seed pests]*. Moscow: Lesnaia promyshlennost. 157 pp. [In Russian]
- Strand, E. 1911a. Eine neue Chalcididen-Gattung und-Art, die zugleich den Typus einer neuen Tribus bildet. *Entomologische Rundschau* 28: 58-59.
- _____. 1911b. Neue und wenige bekannte exotische Arten der Chalcididengattungen *Megastigmus* Dalm., *Mesodiomorus* Strand (n. g.), *Polychromatium* D. T. und *Leucospis* F. Wiener. *Entomologische Zeitung* 30: 93-99.
- Swederus, N. S. 1795. Beskrifning pa et nytt Genus *Pteromalus* ibland Insecterna, hoerande til Hymenoptera, uti Herr Arch. och Ridd. v. Linnes Systema Naturae. *Kongliga Svenska Vetenskaps-Akademien Handlingar* 16: 201-205, 216-222.
- Thomson, C. G. 1876. *Hymenoptera Scandinaviae. Vol. 4. Pteromalus (Swederus)*. Lund: H. Ohlsson. 259 pp. (Dated 1875).
- Turgeon, J. J., K. Kamijo, and G. DeBarr. 1997. A new species of *Megastigmus* Dalman (Hymenoptera: Torymidae) reared from seeds of the Atlantic white cedar (Cupressaceae), with notes on infestation rates. *Proceedings of the Entomological Society of Washington* 99: 608-613.
- Turgeon, J. J., A. Roques, and P. De Groot. 1994. Insect fauna of coniferous seed cones: diversity, host plant interactions, and management. *Annual Review of Entomology* 39: 179-212.
- Vasil'eva, E. A. 1991. [The pistachio chalcid]. *Zaschita Rastenii* 8: 34. [In Russian]
- Vayssiere, P. 1931. Apparition en France du *Megastigmus spermotrophus* Wachtl, parasite des semences du *Pseudotsuga douglasii* Haar. *Revue de Pathologie Vegetale et d'Entomologie Agricole* 18: 180-186.
- Vikberg, V. 1966. Observations on some Finnish species of *Megastigmus* Dalman (Hym. Torymidae), including the biology of *Megastigmus bipunctatus* (Swederus). *Annales Entomologici Fennici* 32: 309-315.
- Wachtl, F. A. 1884a. Beitrag zur Kenntniss der Lebensweise des *Megastigmus collaris* Boh. *Wiener Entomologische Zeitung* 3: 38-39.
- _____. 1884b. Über *Megastigmus pictus* Först. und seine lebensweise. *Wiener Entomologische Zeitung* 3: 214.
- _____. 1893. Ein neuer *Megastigmus* als Samenverwuster von *Pseudotsuga Douglasii* Carr. *Wiener Entomologische Zeitung* 12: 24-28.
- Walker, F. 1833. Monographia Chalcidum. Family II.--Torymidae. *The Entomological Magazine* 1: 115-142.

- _____. 1839. *Monographia Chalciditum*, 2. London: Hyppolite Bailliere. 100 pp.
- _____. 1851. Notes on Chalcidites, and descriptions of various new species. *Annals and Magazine of Natural History* 7: 210-216.
- _____. 1852. Notes on Chalcidites, and descriptions of various new species. *Annals and Magazine of Natural History* 9: 39-43.
- _____. 1862. Notes on Chalcidites, and characters of undescribed species. *Transactions of the Royal Entomological Society of London* 1: 345-397.
- _____. 1869. Notes on Chalcididae; and descriptions of a new species of *Megastigmus*. *Transactions of the Royal Entomological Society of London* 1869: 313-314.
- _____. 1871. *Notes on Chalcidiae. Part II.--Eurytomidae and Torymidae*, pp. 19-36. London: E. W. Newman.
- Wall, I. 1984. System und Biologie der Torymide und Ormyriden Mitteleruopas (Hymenoptera Parasitica Chalcidoidea: Torymidae et Ormyridae), pp. 7-70. In, U. Sellenschol and I. Wall eds., *Die Erzwespen Mitteleuropas, System, Biologie und Bibliographie der Torymidae und Ormyridae*. Keltern: Erich Bauer. 111 pp.
- Walley, G. S. 1932. Host records and new species of Canadian Hymenoptera. *The Canadian Entomologist* 64: 181-189.
- Weiss, H. B. 1917. Notes on several insects not heretofore recorded from New Jersey. *Journal of Economic Entomology* 10: 224.
- Westwood, J. O. 1874. *Thesaurus Entomologicus Oxoniensis*. Oxford: Clarendon Press, 205 pp.
- Wisnioski, B. 1997. Chalcidoidea (excluding Mymaridae). pp. 132-158. In J. Razowski, ed., *Checklist of Animals of Poland, Vol. 5*. Krakow: Polish Academy of Sciences, Institute of Systematics and Evolution of Animals [In Polish and English]
- Wu, H. Y. 1993. [Emergence forecast of *Megastigmus sabinae*]. *Forest Science Technology* 2: 4-6. [In Chinese]
- Wu, H. Y., D. H. Zhang, and D. Y. Chen. 1992. [Studies on the bioecology of *Megastigmus sabinae*]. *Scientia Silvae Sinica* 28: 367-371. [In Chinese]
- Xu, Z., and J. He. 1989. [Description of a new species of *Megastigmus* Dalman]. *Acta Zootaxonomica Sinica* 14: 482-485. [In Chinese with English summary]
- _____. 1995. [Note on species of phytophagous group of *Megastigmus* (Hymenoptera: Torymidae) from China]. *Entomotaxonomia* 17: 243-253. [In Chinese with English summary]
- Yano, M. and M. Koyama. 1918a. [On the wasps parasitizing the seeds of coniferous trees]. *Report of Forest Experiment, Forestry Bureau* 17:38-58. [In Japanese]

—. 1918b. [On the wasps parasitizing the seeds of coniferous trees]. *Insect World* 22: 322-325, 372-376, 497-503. [In Japanese]

Yasumatsu, K. 1955. [Investigations on the parasites of the chestnut gallwasp]. *Shinrin Boeki News* 4: 100-102. [In Japanese]

Yasumatsu, K., and K. Kamijo. 1979. Chalcidoid parasites of *Dryocosmus kuriphilus* Yasumatsu (Cynipidae) in Japan, with descriptions of five new species (Hymenoptera). *Esakia* 14: 93-111.

Yates, H. O. 1986. Checklist of insect and mite species attacking cones and seeds of world conifers. *Journal of Entomological Science* 21: 142-168.

Yoshimoto, C. M. 1979. A new species of *Megastigmus* from Mexico. *The Canadian Entomologist* 111: 201-206.

Zerova, M. D., and L. Y. Seryogina. 1994. [*The seed-feeding Chalcidoidea of Palaearctics*]. Kiev: National Academy of Sciences of Ukraine, L. L. Schmalhausen Institute of Zoology, Naukova Dumka. 237 p. [In Russian]

Zhang, X. D. and Y. J. Zhou. 1990. [*Megastigmus pictus* a new seed pest in the Daxinganling Mountains]. *Forest Pest and Disease* 2: 20-21. [In Chinese]