



Full Length Article

Illustrated Key to the Genera of Family Chalcididae (Hymenoptera: Chalcidoidea) from Various Ecological Zones of Khyber Pakhtunkhwa, Pakistan

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Abstract

A study was initiated on Taxonomy of Chalcididae from various ecological zones of Khyber Pakhtunkhwa, Pakistan. Diverse ecological zones were surveyed at different times and seasons of the year. Most of the collection was done from grasses, low vegetation, barren lands, forests, agricultural crops and orchards during different months of the years 1995–2014. The study was based on the examination of 200 specimen collected during this time. Among them, eleven genera of Chalcididae are recorded from different agro-ecological zones of Khyber Pakhtunkhwa, Pakistan. These genera include *Epitranus* Walker, *Chalcis* Fabricius, *Brachymeria* Westwood, *Dirhinus* Dalman, *Neochalcis* Kirby, *Antrocephalus* Kirby, *Kriechbaumerella* Dalla Torre, *Neohybothorax* Nikol'skaya, *Psilochalcis* Kieffer, *Hockeria* Walker and *Proconura* Dodd. Six genera, *Antrocephalus*, *Chalcis*, *Kriechbaumerella*, *Neochalcis*, *Neohybothorax* and *Proconura* are new records for Pakistan, while all the genera except *Hockeria*, *Dirhinus* and *Brachymeria* are new records for Khyber Pakhtunkhwa. All the specimens were identified with the help of available literature and comparison with paratypes present at Bohart Museum of Entomology, University of California, Davis, USA. An illustrated key to these genera is provided. © 2018 Friends Science Publishers

Keywords: Taxonomy, Chalcididae, parasitoids, new genera, natural enemies, Pakistan

Introduction

Members of the family Chalcididae are medium to large sized insects varying in size from 1.5 mm to 27 mm in length. They can be recognized by the coarse setiferous punctures on head and thoracic dorsum, enlarged and swollen metafemur with denticulate or toothed ventral margin, arched metatibia and larger metapleuron (Gibson *et al.*, 1997). Chalcididae are similar to Leucospidae in most of the features including, body size, coarse setiferous punctures on head and thorax, enlarged and toothed metafemur and arched metatibia. But Chalcididae differs from Leucospidae in a number of characters: the flat forewing instead of folded lengthwise, usually exposed labrum, poorly developed labiomaxillary complex, the tegula more or less broad and oval, the usually modified apex of scutellum and simple dorsellum (Bouček, 1974). Some Torymids of the subfamily Podagrioninae are also similar to chalcidids but the lack of setiferous punctures and long ovipositor in torymids separates them from chalcidids.

Species of family Chalcididae are endoparasitoids of insects in the orders Lepidoptera, Coleoptera, Diptera and Hymenoptera. Many species in these orders are pests of economic importance. Chalcidids, therefore, are generally beneficial to humans as a group, as they keep various crop

pests under control, and many species have been used to control insect pests. They have a significant part to play in ecosystems and their true importance must not be underestimated (Cowan, 1979; Ubaidillah, 1996).

Studies on chalcidids began more than 200 years ago when (Linnaeus, 1767) described the species *Spex sispes* (*Chalcis sispes*), *Vespa minuta* (*Brachymeria minuta*) etc. Linnaeus was followed by Fabricius (1787), Spinola (1811), Westwood (1829), Kirby (1883), Torre and Van (1897). Among later studies, Walker (1834), Ashmead (1897), Ashmead (1904), Cameron (1904), Girault (1911), Masi (1929a,b), Schmitz (1946a, b), Bouček (1952), Nikol'skaya (1952), Mani and Kurian (1953), Habu (1960) and Narendran (1989a) have made significant contribution to the knowledge of Chalcididae.

In Pakistan, most of the taxonomic work on Chalcididae has been done in Karachi University. Khokhar *et al.* (1971) described *B. bicolorata* as pupal parasite of *Earias* spp. on cotton from Sind. Samad *et al.* (1971) recorded *B. ocellata* as pupal parasite of fruit fly, *Dacus ferruginus* in Karachi. Sheikh *et al.* (1987) described two new species including *B. alba* and *B. mandibulata* from Sindh province. They also reported *B. truncata* as newly recorded species from Pakistan. Rafi *et al.* (1987) described two new species, *B. dentata* and *B. kafimu* and *B. incerta*

(Cresson) from Sindh province, reared from cotton bollworm. Ishrat and Malik (1987) described three new species in the genus *Brachymeria* from Sind Province, including *B. sindhensis*, *B. qadeeri* and *B. karachiensis*. Ahmed *et al.* (1987) described two new species from Sindh, *B. multidentata* and *B. oblique*. Narendran (1989b) reported some species of Chalcididae from Pakistan. Noyes (2014) reported 29 species in 7 genera from Pakistan, along with distributional, taxonomic and biological information on most of the species. Irshad (2003) provided host records and distribution of fourteen species from Pakistan. Out of the 14 species, 6 were from Khyber Pakhtunkhwa province. Iqbal *et al.* (2013), Iqbal and Inayatullah (2015), Iqbal *et al.* (2015a, b) reported 8 more species raising the number of reported species to 14 from the province. Recently, Khaliq *et al.* (2016) reported one species as hyper-parasitoid of *Cotesia plutella* (Braconidae; Hymenoptera).

Based on abovementioned information on Chalcid parasitoids, there was a need to find out occurrence of these natural enemies in various ecological zones of Khyber Pakhtunkhwa, Pakistan. Our neighboring countries have reported many species from this family; however, this group remained unexplored in other parts of Pakistan. Current study was initiated to provide first ever key for the identification of Chalcidid genera from Khyber Pakhtunkhwa province of Pakistan.

Materials and Methods

This study was based on 200 specimens collected between 1995 and 2014 from different ecological zones of the Khyber Pakhtunkhwa Province, Pakistan. Some of parasitoids of Chalcididae were reared from larvae of Lepidoptera, Diptera and Coleoptera in the laboratory. Chalcidids were also collected from grasses, low vegetation, barren lands, forests, agricultural crops and orchards using Malaise traps and sweep nets. Collected specimens were preserved in 70% alcohol and then transferred to 97% alcohol for 5 hours before point mounting. Most Chalcididae were too small to pin, specimens were therefore mounted on card points. Gibson *et al.* (1997) was followed for morphological terms whereas for terminology of surface sculpturing, Harris (1979) was followed.

Most of the specimens were identified with the help of available literature i.e., (Nikol'skaya, 1952; Habu, 1960, 1962; Bouček, 1988, 1992; Narendran, 1989; Gibson *et al.*, 1997;). Specimens were also compared with paratypes at the Bohart Museum of Entomology, The University of California, Davis, USA. A Nikon SMZ 745T microscope was used for identification, and a Camera Lucida was used to draw illustrations of important characters.

All the research material was deposited in the Insect Museum of the Department of Entomology, The University of Agriculture, Peshawar.

Results

Key to the Genera of Chalcididae of Pakistan

1. Metatibia tapering apically into strong spine extending far beyond insertion of tarsus (Figs. 1 and 9), usually with one (often inconspicuous) spur between tips of spine and tarsus; metafemur ventrally either with long comb of teeth or with small or large gaps between the teeth 2
 - Metatibia with apex truncated almost perpendicularly or slightly sinuate, with 2 apical spurs (Figs. 2–8); ventrally metafemur with dense comb (mostly on lobes) of short or long denticles; Haltichellinae 5
2. Metasoma compressed and petiole bulging ventrally (Fig. 10); petiole slender, longitudinally striate and longer than half of metasoma (Fig. 11); antennae inserted just above clypeus; antennal scrobe obsolete (Fig. 18); forewing with marginal vein very long, postmarginal vein absent and stigma rudimentary (Fig. 26); Epitraninae *Epitranus* Walker.
 - Metasoma completely different from above, petiole either invisible or much shorter than half of gaster; not longitudinally striate; other characters variable; Chalcidinae..... 3
- 3 Petiole distinctly longer than wide (Fig. 9); propodeal spiracle vertically elongate (Fig. 41); postmarginal vein several times longer than stigmal vein (Fig. 27); Chalcidini..... *Chalcis* Fabricius.
 - Petiole much broader than long, mostly concealed in dorsal view; propodeal spiracles elongate in oblique sub horizontal direction; postmarginal vein various 4
- 4 Postmarginal vein often longer than stigmal vein (Fig. 28); upper part of head without horn shaped structure; petiole without longitudinal ridges; malar suture between mouth and eye distinct, usually indicated by carina (Fig. 19); Brachymerini *Brachymeria* Westwood
 - Postmarginal and stigma veins rudimentary, marginal vein of forewing unusually long (Fig. 29); upper part of head produced into 2 strong horn shaped structures (Fig. 12); petiole with longitudinal ridges (Fig. 12); tergum 1 longer than other segments, with longitudinal striations anteriorly (Fig. 12); metatibia with row of small arched ventrally teeth; Dirhininae *Dirhinus* Dalman
- 5 Forewing with marginal vein at wing margin, postmarginal vein present, stigmal vein distinctly developed (Fig. 30 and 31); mesosoma mostly dull with narrow interspaces of punctures; flagellum usually with short setae; Haltichellini 6
 - Forewing with short marginal vein separated from anterior margin, postmarginal vein absent (Figs. 32–34); mesosoma often shiny with broad interspaces, rarely dull and densely punctured; in female, flagellum usually bare but in male rarely slightly setose; Hybothoracini 9

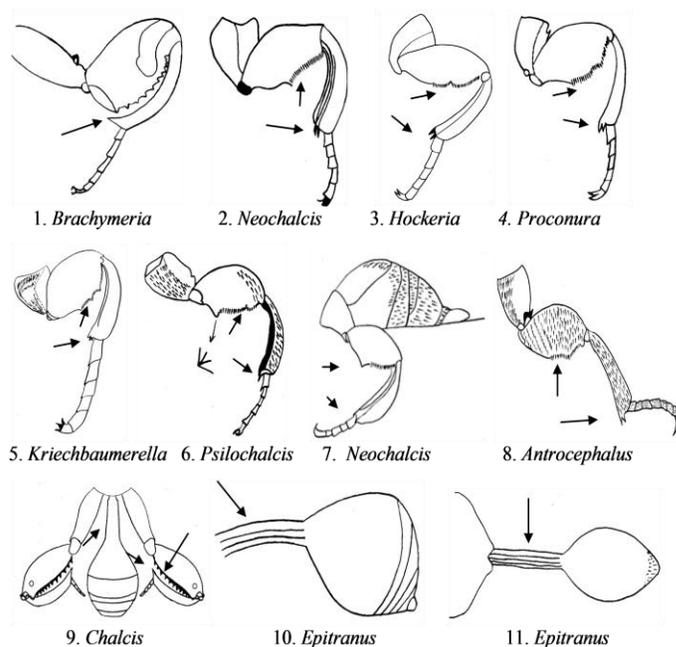


Fig. 1–8: Lateral view of hindfemur; **Fig. 9:** Dorsal view of hindlegs and metasoma
Fig. 10: Lateral view of metasoma; **Fig. 11:** Dorsal view of metasoma

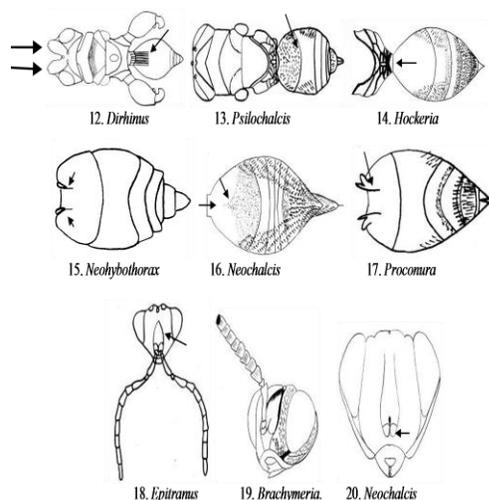


Fig. 12–13: Dorsal view of body; **Fig. 14–17:** Dorsal view of Metasoma; **Fig. 18:** Anterior view of Head
Fig. 19: Oblique frontal view of head; **Fig. 20:** Anterior view of Head

6 Metafemur with prominent dent on ventral margin followed by comb of teeth (Fig. 2 and 7); tergum without longitudinal carina basally, often with microsculptures (Fig. 16); antennal toruli present slightly above clypeus (Fig. 20); apex of scutellum without large teeth, usually with two short dents but occasionally entire or rounded *Neochalcis* Kirby
 - Metafemur without dent on ventral margin; tergum without longitudinal cariane basally, however with median fovea between two small ridges; antennal toruli present

much above clypeus; scutellum usually emarginate, with prominent teeth.....7
 7 Frons with strong horseshoe shaped preorbital carina, joining behind median ocellus along inner margins of eyes (Fig. 38); scrobal depression variable; may reach median ocellus; tergum 1 with basal fovea, delimited by small ridges on both sides; pronotum with anterolateral carina may or may not reach dorsal surface; metafemur may be bilobed or trilobed, metatibia without additional carina 8

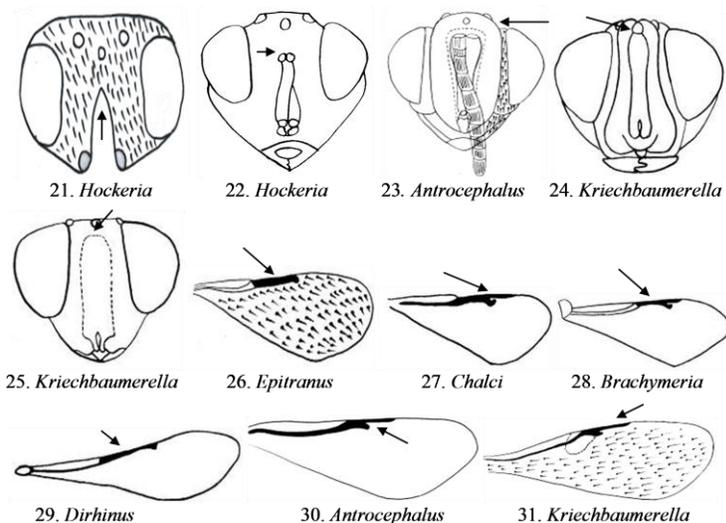


Fig. 21: Dorsal view of head; Fig. 22–25: Anterior view of head; Fig. 26–31: Fore wing

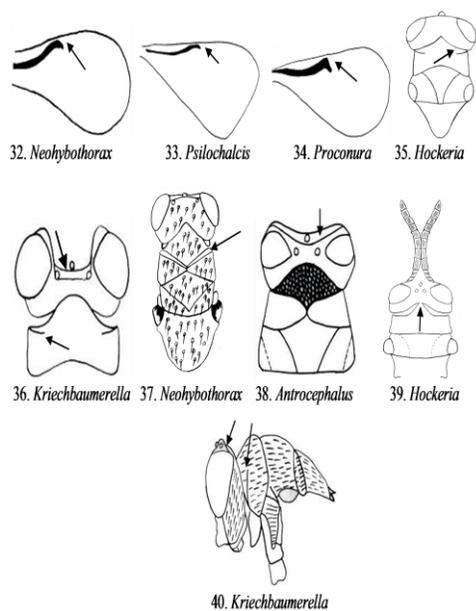


Fig. 32–34: Forewing; Fig. 36–39: Dorsal view of mesonotum; Fig. 40: Lateral view of head and mesosoma

- Frons without horseshoe shaped preorbital carina or preorbital carina weak but not reaching median ocellus (Fig. 21 and 22); scrobal depression smaller not reaching median ocellus (Fig. 21 and 22); tergum 1 without basal fovea and carina at base (Fig. 14); pronotum with anterolateral carina not ascending to dorsal surface, dorsomedian surface rounded (Figs. 35 and 39); metafemur mostly with 2 denticulate lobes, metatibia with or without additional carina (Fig. 3) *Hockeria* Walker

8 Head with large scrobal depression delimited laterally by strong preorbital carinae which unite dorsally behind median ocellus in horseshoe shape (Figs. 23, 38); ventrally

metafemur uni or bilobed (Fig. 8); anterior pronotal carina on pronotum usually with paired strong or weak tubercles medially; forewing without any brown patch near marginal and stigmal vein (Fig. 30) *Antrocephalus* Kirby

- Head with shallow scrobal depression; preorbital carina on inner margin of eye present but may or may not unite behind median ocellus (Figs. 24, 25, 36 and 40); metafemur ventrally trilobed (Fig. 5); pronotum convex with anterior pronotal carina restricted to sides only, not forming a tubercle (Figs. 36 and 40); forewing with a brown patch just below marginal and stigmal vein (Fig. 31) *Kriechbaumerella* Dalla Torre

9 Propodeum with posterolateral angles extending backwards like horns (Fig. 42); forewing with marginal vein slightly removed from wing margin, postmarginal vein absent, stigmal vein reduced in to stub (Fig. 32); strong anterior pronotal carinae coming up to middle where it becomes weak (Fig. 37); tergum 1 with pair of carina at anterior margin running perpendicular to propodeum (Fig. 15)..... *Neohybothorax* Nikol'skaya

- Propodeum rounded or truncated without horn like posterolateral angles extending backwards; forewing with premarginal vein either very thin, or very thick and stigmal vein distinct; anterior pronotal carina absent or reaching up to shoulders laterally; tergum 1 with or without distinct carinae

10 Metafemur with large basal tooth (Fig. 6); tergum 1 with posterior margin arcuate, weakly or strongly shagreened (Fig. 13); forewing with premarginal vein very thin (Fig. 33); antennae entirely dark brown

Psilochalcis Kieffer
- Metafemur without a basal tooth (Fig. 4); tergum 1 with two distinct carinae anteriorly, delimiting basal fovea on sides (Fig. 17); forewing with premarginal vein thick (Fig. 34); antennae with basal 2 flagellomeres light brown, rest dark brown

Discussion (Footnote)

The key constructed for the identification of genera of Chalcididae of Khyber Pakhtunkhwa, Pakistan, is being reported for the first time as far as literature on Chalcidids from Pakistan are concerned. Based on 200 specimens collected, it was found that Chalcididae species are very rarely encountered as majority of the genera are represented by only few specimens. These wasps can only be found in a specific time and at particular places. However, Chalcidids seem to be more abundant in the warm, plain and cropped areas of the province as compared to hilly areas, forests and orchards.

Published information reveals that so far 29 species in seven genera have been recorded from all over Pakistan. Our studies raised the number of Chalcidid genera by 11 from Khyber Pakhtunkhwa. This number is low when compared with neighboring countries, reasons recognized are incomplete surveys, poor collection methods and lack of local information on Chalcidids. Thus, extensive research work is suggested in other parts, Punjab, Baluchistan, Gilgit-Baltistan and Kashmir is required to form basis for regional data and to record their effectiveness as natural enemies against various insects' pests of economic importance.

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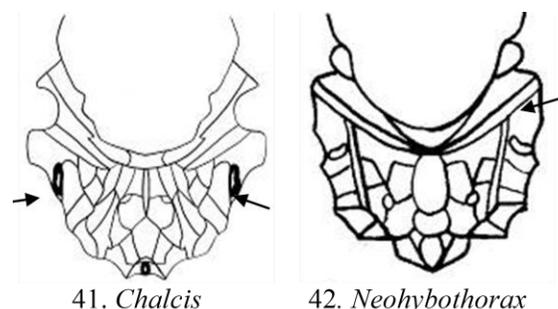


Fig. 41–42: Propodeum, dorsal view

– IRSIP) to study and compare specimens with paratypes at Bohart Museum of Entomology, University of California, Davis, USA. Authors are also thankful to The Director, Bohart Museum of Entomology, Prof. Dr. Lynn S. Kimsey and insect curator Dr. Steve L. Heydon for their support during stay at UC Davis.

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