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Morphometric studies of *Dirhinus giffardii* (Silvestri) and *Aganaspis daci* (Weld) from Tandojam

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Author's contribution
NA conceived and designed the experiment. IA reared the samples analyses the data QBP wrote the manuscript and help in statistical analysis.

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ABSTRACT

Investigations were made for morphometric studies on pupal parasitoid (*D. giffardii*) of fruit fly and larval parasitoid *Aganaspis daci* (Weld, 1951). Both males and females of *Dirhinus giffardii* Silvestri and *Aganaspis daci* were studied. Further, morphometric analyses of 15 specimens of each species were taken. Following 15 characters were selected i-e adult total length include wings, eyes width in cross, antenna length, head width mesoscutum, scutellum, following length hindwing, forleg, mid leg, hind-leg, abdomen length, abdomen width, aedeagus and ovipositor length. It was observed that males of *D.giffardii are* larger than males of *A. Daci*, Eyes of *D. giffardii* are bigger than A. Daco. Legs of A. Daciare larger than D. giffardii, ovipositor of A. daci is too long whereas *D. giffardiiis* much shorter in length the range of the size of laboratory population of the selected parasitoids is known

1. INTRODUCTION

Morphologically, biological species are enormously a like in their body structure and functions but their documentation are not easy and a lot of composite of such cryptic or sibling species go hidden [1]. The quantitative study of the size and shapes of organisms is called morphometrics. The phenomena which involved measurement of body parts like limbs or internal organs and indicates prominent evolutionary picture of these measurement. Now-a-days referred to as conventional morphometric and multivariate statistical techniques (e.g. discriminate function analysis) for organism morphological information record.Standard multivariate methods including linear distances for shape were highly correlated and extra effort was expended for correcting of size [2]. To eradicate these issues by developing method "Geometric Morphometrics Revolution" which permitted the analysis of partsand complete organism shapes [2-4]. Inconventional morphometric examination, linear distance was calculated among couple of similar morphological attraction [4, 5].

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Multivariate analysis is used for the determination of these inter landmark distances. Wing shape difference indicates various additive genes examination of wing shape [6, 7]. It consists of broadly in mutually captive and natural populations [6, 8]. Among wild population line variation is most prominent in wing shape determination [6]. However, morphometric studies are helpful in biological experiments to find out effect of various foods, environment on the shape and size of body, it is very important when insects are reared on artificial diets under captive environment and the morphometric suggests whether the reared species is healthy and can be utilized for the purposes. Present study has been conducted for the first time on selected species, both are natural enemies of fruit flies and these are reared on a large scale under laboratory conditions. Looking at the importance of morphometric present studies attempt is made.

2. MATERIALS AND METHODS

2.1 *Study Site*

All the experimental material was centered at the fruit fly rearing laboratories of Nuclear Institute of Agriculture, Tandojam. Some part of the study was also executed in the controlled laboratory condition (Temp

26±2°C, RH 60-65%) of the Department of Entomology Sindh Agriculture University Tandojam. The fruits fly were collected by visiting the designated orchards in Tandojam at regular intervals.

2.2 Laboratory observations
Investigation was made for sexual dimorphism by comparing male and female sizes to determine if the sexes were dimorphic in size and shape.

2.3 Selection of material
From collected material, 15 specimens were selected each male and female for analysis.

2.4 Body characters
Prominent external body parts were measured including; head, pronotum, thorax, abdomen, legs, antenna, eyes, ovipositor and male genitalia.

2.5 Data analysis
The data is represented through descriptive statistics, through the statistical software SXW 8.0.

3. RESULTS

Results are categorized in two division identification of both species i.e. *Dirhinus giffardii* Silvestri, (1913), *Aganaspis daci* (Weld, 1951) morphometrics analysis.

3.1 *Identification:*
Both males and females of *Dirhinus giffardii* Silvestri, (1913), *Aganaspis daci* (Weld, 1951) are analyzed for their characters and presented here in plates 1-2. Further, Taxonomic hierarchy and description is given below with each species of male and female.

3.2 *Dirhinus giffardii* (Silvestri, 1913)

3.2.1 *Description*
Like other members of genus, *Dirhinus giffardii* Silvestri can be recognized by antennae, scape of antennae, moderately broad, incised apex, Inner side somewhat surpassing outer, apex subacute. Head and thorax blackish copper- green in color, abdomen shining black. Wings hyaline brownish veins. Front wings stigmatic vein very short. First and second pairs legscoxae black, the rest brick-red, third pair tarsus brick-red, the rest black. Femora posterior legs as other chalsidids erectly swollen and -dentate beneath for almost whole opposite side tibia. Pronotum covered circular faveolae each short central Mesonotum same sculpture as pronoturn. Propodium lateral submedian angles acute. Abdomen segments chitinized and compressed oval very acute posteriorly. Male's abdomen slightly rounded than females. Average length of whole body is 4.2 mm, of antennae is 1.8 mm, and of front wings is 2.75 mm seta. Characters selected for *Dirhinus gifferdii*: Total 15 characters were selected; adult total length incl. wings, eyes width in cross, antenna length, head width, mesoscutum, scutellum, forewing length, hindwing, foreleg, midleg, hindleg, abdomen length, abdomen width, aedeagus length, ovipositor length.

Table. 1 Morphmetric characteristic of *Dirhinus gifferdii* ♂

Body Parameters (mm)	Mean	Range
Antenna	6.58	5.91-7.23
Eye in cross section	3.30	2.97-3.63
Head width	5.64	5.07-6.19
Foreleg	8.72	7.84-9.58
Forewing	13.67	12.29-15.02
Hind leg	12.68	11.39-13.93
Hind wing	7.61	6.84-8.36
Mesonotum	4.80	4.31-5.27
Mid leg	10.12	9.09-11.11
Scutellum	4.44	4.00-4.88
Abdomen length	5.05	4.54-5.54
Abdomen width	3.43	3.09-3.77
Aedeagus	5.43	4.88-5.96

Table. 2 Morphmetric characteristic of *Dirhinus gifferdii* ♀

Body Parameters (mm)	Mean	Range
Antenna	9.92	8.91-10.89
Eye in cross section	4.97	4.46-5.56
Head width	8.12	7.30-8.92
Foreleg	12.88	11.57-14.15
Forewing	19.51	17.53-21.43
Hind leg	18.61	16.72-20.44
Hind wing	11.05	9.93-12.13
Mesonotum	7.43	6.68-8.16
Mid leg	13.89	12.48-15.26
Scutellum	6.66	5.99-7.32
Abdomen length	8.05	7.24-8.84
Abdomen width	5.27	4.73-5.79
Ovipositor	13.90	12.49-15.27

3.3 *Aganaspis daci* (Weld, 1951)

3.3.1 *Description*
Its diagnostic characters are: eyes scattered hairs; female antenna moniliform, articles short, markedly longer than; club 8-9 segmented, conspicuous. Article 3 male antenna very long, bent, dilated distally, distinctly longer than 4.Scutellar cup very large, overhanging behind rounded disc. Radial cell this genus is entirely open on anterior margin of forewings, in all described species. Male and female normal body shape, not strongly compressed laterally. Head, in dorsal view, slightly broader than long(4.5:3). Female antenna 9-segmented club; article 3 male longer than 4(8.3:4.8).Forewing discal setae, elongate; rounded at apex; marginal setae short; radial cell deep.Scutellar cup oblongo-ovate, posterior margin of scutellum

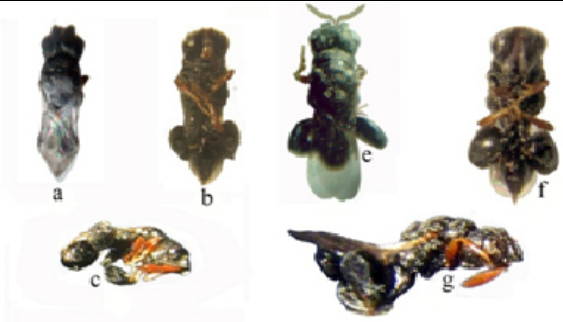
perpendicular relation to cup. For morphometric analysis of both species fifteen specimens of each species males and females diagnosed and the results are presented here in graphs. Characters selected for *Aganaspisdaci*: Total 15 characters were selected; adult total length incl. wings, eyes width in cross, antenna length, head width, pronotum, mesonotum, scutellum, forewing length, hindwing length, foreleg, midleg, hindleg, abdomen length, abdomen width laterally, ovipositor length.

Table. 3 Morphmetric characteristic of *Aganaspis daci* ♂

Body Parameters (mm)	Mean	Range
Antenna	10.36	9.31-11.37
Eyes width	2.476	2.47-3.01
Head width	3.83	3.45-4.21
Foreleg	12.55	11.28-13.78
Forewing	16.45	14.78-18.06
Hind leg	23.78	21.37-26.11
Hind wing	12.13	10.90-13.32
Mesonotum	5.290	4.750-5.810
Mid leg	14.41	12.95-15.83
Pronotum	1.50	1.35-1.65
Scutellum	2.10	1.89-2.31
Abdomen length	8.88	7.98-9.76
Abdomen width	6.13	5.51-6.73

Table. 4 Morphmetric characteristic of *Aganaspis daci* ♀

Body Parameters (mm)	Mean	Range
Antenna	13.63	12.25-14.97
Eyes width	3.68	3.31-4.05
Head width	5.32	4.78-5.84
Foreleg	17.23	15.48-18.92
Forewing	23.14	24.57-25.41
Hind leg	27.35	24.57-30.03
Hind wing	16.57	14.89-18.19
Mesonotum	7.27	6.53-7.99
Mid leg	18.13	16.29-19.91
Pronotum	2.03	1.83-2.23
Scutellum	2.84	2.56-3.12
Abdomen length	12.14	10.91-13.33
Abdomen width	8.35	7.51-9.17
Ovipositor	24.34	21.87-26.73



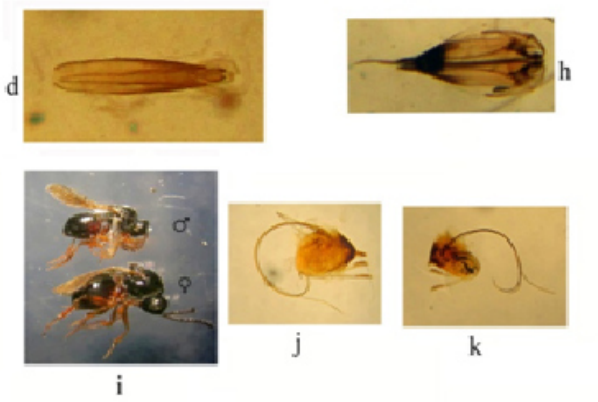


Fig 1 a-h *Dirhinus gifferdii* (a) male Adult dorsal view (b)male adult ventral view (c) male adult lateral view (d) aedeagus dorsal view (e) female adult dorsal view (f) female adult ventral view (g) female adult lateral view (h) female genital complex. i-k*Aganaspisdaci*(i) male and femal adult lateral views (j,k) female genital complex.

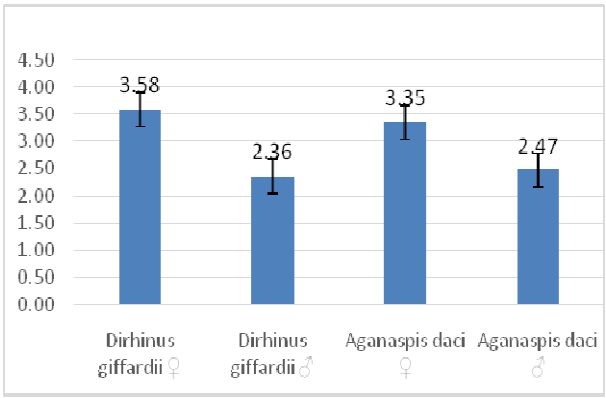


Fig 2 Total length include: wings of adults of *Dirhinus giffardii* & *Aganaspisdaci* (Male and Female)

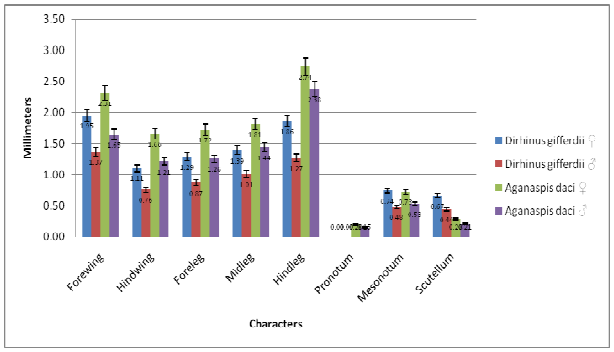


Fig 3. Measurement (X ± S.E) of thorax (mm) of *Dirhinus gifferdii*&*Aganaspis daci* (♂♀)

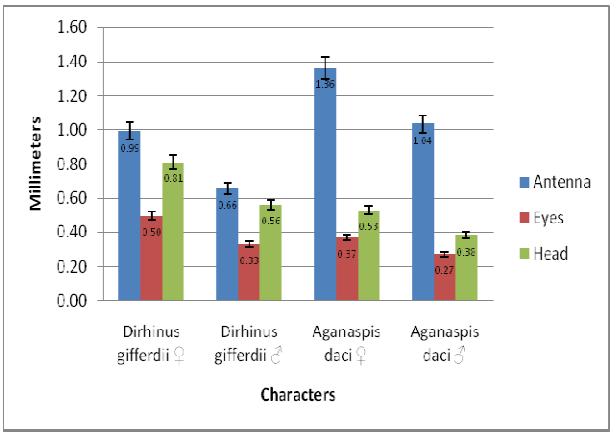


Fig 4. Measurement (X ± S.E) head (mm) of *Dirhinus gifferdii&Aganaspis daci* (♂♀)

4. DISCUSSION

When separate biological species are extremely similar in morphology, document their existence often difficult and many complexes of such cryptic or sibling species go undetected, languishing under single nominal species names. Observation behavioral or ecological polymorphisms, however, may hint at such sibling and have proven especially informative systematic studies of herbivorous insect taxa. Main cause of metric differences related to physiology is obviously differential growth, when this growth heterogeneity is of environmental origin. Depending on more or less favorable environmental conditions, and on aging, individuals may be more or less developed. For con-specific individuals, traditional morphometrics proposes set of statistical methods to remove this effect of age or growth from their metric variation. Scaling for size is interesting when one wants to remove the effects of physiological differences and concentrate on other causes of intra-specific variation. The differences may be due to adaptive causes, pathological causes, genetic causes. No previous work on *D. giffardii* and *As daci* is reported on morphometrics, our results indicates that males of *D. giffardii* are larger than males of *A. daci,* the males of *daci* are slightly bigger than that of *giffardii.* Eyes of *giffardii* are bigger than *daci*. Legs of *daci* are larger than *giffardii*, ovipositor of *daci* is too long where as *giffardii* is much shorter in length.

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