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Status of taxonomic entomology in Pakistan: Research, education, problems and possible solutions

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Abstract

Taxonomy is considered basic for research in the field of biology. It has correlation with all important fields of study like ecology, medicine, biodiversity, agriculture etc. By collecting the data regarding new species recorded from 2000 to 2017, the work of Pakistani taxonomists is negligible against taxonomy of insects as they covered only some parts of these orders like Coleoptera, Hymenoptera, Orthoptera, Odonata, Diptera, Neuroptera and Phthiraptera. Topography and climatic conditions of this country is favorable for insect biodiversity but there are some challenges need to overcome by financial support, taxonomy as a compulsory subject for zoology students, conduction of short national and international training programs, availability of related literature, enough journals to publish work and establishments of identification centers.

Keywords: Taxonomy, Pakistan, species, new record, problems

1. Introduction

Pakistan is located between longitude 60° to 77° East and latitudes 23° to 37° North, stretches north to south 1,600 km and east to west 885 km, having total area of 796,096 km² [1,2]. The annual rainfall 125 mm in plain while 500 to 900 mm in mountainous areas, the country has semiarid, tropical and subtropical climate with maximum average temperature 40 °C in summer and minimum in winter near to freezing point [3-6]. Pakistan has fauna in abundance like as Ethiopian, Oriental and Palearctic which represents coastal areas of Sindh, Rajasthan (India), China, Afghanistan, Russia [7,8]. Agriculture is backbone of this country [9,10] but unfortunately all important crops, plants and stored products infested by known and unknown pests [11,12], resulting a valuable economic loss every year [13-15]. This sector plays a key role in economic development of the country as well provides food to people and contributes considerable share of foreign exchange [63].

Taxonomy provides base of all research in the field related to biology as before start of any type of research, it is very important to know the accurate name of that specie [16]. This branch has relevance to different fields like fisheries, medicine, agriculture, conservation, ecology, biodiversity [17]. Classification is very important as it lets researchers to identify, group, and properly name organisms through a standardized system; based on resemblances found in the organism's genetics, adaptations, and embryonic development to other known organisms to better study and recognize the new creature as a whole [61]. Insect's fauna present more than half of animals [18]; comparison with developed nations, the taxonomic work in Pakistan is very fragmentary [19-21]. It needs observation to analyses the taxon determination at specie or intera specific level as well as several discussions and consultations with other experts for taking a final decision in identification process [17].

2. Past and present status

Pre-independence of Pakistan, foreigner researchers studied the taxonomy of insects present in subcontinent [22]. During post-independence period, this important task has been shifted to students. Currently, Pakistan Agricultural Research Council (PARC) Islamabad, Ayub Agricultural Research Institute (AARI) Faisalabad, a few institutions and universities carry out the job of taxonomic research on Pakistani insects.

3. Future prospects

Gahan ^[23] who stated on the taxonomy of world insects: ‘The tremendous worldwide interest in the economic entomology has resulted in swelling the number of economic workers to a veritable army, while the number of systematists has apparently not kept pace’. This statement is still relevant today, where the relatively few Pakistani taxonomists are confronted with several of species. So, no need to wonder if a lot of insect’s diversity only has generic names and a lot of species names still with question mark. Geopolitically, Pakistan is considered as an important region, as have

variable habitats and water resources in different forms like streams, snow, rivers and springs ^[1]. Therefore we must have a taxonomic knowledge about the fauna of this country. According to estimations of taxonomists, 14 million species present in world ^[24], among them only 2 million scientifically identified and named; indicated that a lot of work required to fill that vacuum ^[25].

4. New recorded species in Pakistan

This table showed the new species recorded in Pakistan from year 2000 to 2017 and their distribution within Pakistan.

Table 1: New recorded species from Pakistan in different areas (KPK= Khyber Pakhtunkhwa, AJK= Azad Jammu and Kashmir)

S. No	Species	Family	Order	Distribution within Pakistan	References
1	<i>Scymnus (Scymnus) contortubus</i> Rashid	Coccinelloidea	Coleoptera	Kashmir, KPK, Punjab	Rashid <i>et al.</i> , 2017 ^[26]
2	<i>Sepsis barbata</i>	Sepsidae	Diptera	Gilgit-Baltistan	Hassan <i>et al.</i> , 2017 ^[27]
3	<i>Sepsis punctum</i>	Sepsidae	Diptera	Gilgit-Baltistan	Hassan <i>et al.</i> , 2017 ^[27]
4	<i>Sepsis thoracica</i>	Sepsidae	Diptera	Gilgit-Baltistan	Hassan <i>et al.</i> , 2017 ^[27]
5	<i>Decachaetophora aeneipes</i>	Sepsidae	Diptera	Gilgit-Baltistan	Hassan <i>et al.</i> , 2017 ^[28]
6	<i>Dicranosepsis crinita</i>	Sepsidae	Diptera	Gilgit-Baltistan	Hassan <i>et al.</i> , 2017 ^[28]
7	<i>Conocephalus (Anisoptera) fuscus</i>	Tettigoniidae	Orthoptera	Pakistan	Sadiq <i>et al.</i> , 2017 ^[29]
8	<i>Chaetosiphon (Pentarichopus) fragaefolii</i>	Aphididae	Hemiptera	AJK	Amin <i>et al.</i> , 2017 ^[30]
9	<i>Chaetosiphon (Pentarichopus) thomasi</i>	Aphididae	Hemiptera	AJK	Amin <i>et al.</i> , 2017 ^[30]
10	<i>Chaetosiphon (Pentarichopus) tetraerhodum</i>	Aphididae	Hemiptera	AJK	Amin <i>et al.</i> , 2017 ^[30]
11	<i>Metopolophium montanum</i>	Aphididae	Hemiptera	AJK	Amin <i>et al.</i> , 2017 ^[30]
12	<i>Myzaphis rosarum</i> (Kaltenbach)	Aphididae	Hemiptera	AJK	Amin <i>et al.</i> , 2017 ^[30]
13	<i>Myzaphis turanica</i>	Aphididae	Hemiptera	AJK	Amin <i>et al.</i> , 2017 ^[30]
14	<i>Mecopoda platyphoea</i>	Tettigoniidae	Orthoptera	Pakistan	Panhwar <i>et al.</i> , 2016 ^[31]
15	<i>Afromecopoda monroviae</i>	Tettigoniidae	Orthoptera	Pakistan	Panhwar <i>et al.</i> , 2016 ^[31]
16	<i>Scymnus (Pullus) syriacus</i> Marsuel	Coccinellidae	Coleoptera	Sindh Province	Ali <i>et al.</i> , 2016 ^[32]
17	<i>Scymnus (Pullus) castaneus</i> Sicard	Coccinellidae	Coleoptera	Sindh Province	Ali <i>et al.</i> , 2016 ^[32]
18	<i>Scymnus (Pullus) quadrillum</i> Motschulsky	Coccinellidae	Coleoptera	Sindh Province	Ali <i>et al.</i> , 2016 ^[32]
19	<i>Brachymeria excarinata</i>	Chalcididae	Hymenoptera	Punjab	Khaliq <i>et al.</i> , 2016 ^[33]
20	<i>Microthespis oderai</i>	Mantidae	Mantodea	Sindh	Jawaid <i>et al.</i> , 2016 ^[34]
21	<i>Epitranus elongatulus</i> (Motschulsky)	Chalcididae	Hymenoptera	KPK	Iqbal <i>et al.</i> , 2015 ^[35]
22	<i>Epitranus parvidens</i> (Strand)	Chalcididae	Hymenoptera	KPK	Iqbal <i>et al.</i> , 2015 ^[35]
23	<i>Plesiotypus chitralensis</i>	Braconidae	Hymenoptera	KPK	Mian <i>et al.</i> , 2015 ^[36]
24	<i>Tettigonia caudata</i>	Tettigoniinae	Orthoptera	Chitral	Sultana <i>et al.</i> , 2015 ^[37]
25	<i>Oniticellus pallipes</i> Fabricius	Scarabaeidae	Coleoptera	Punjab	Ali <i>et al.</i> , 2015 ^[38]
26	<i>Oniticellus spinipes</i> Roth	Scarabaeidae	Coleoptera	Punjab	Ali <i>et al.</i> , 2015 ^[38]
27	<i>Oniticellus cinctus</i> Fabricius	Scarabaeidae	Coleoptera	Punjab	Ali <i>et al.</i> , 2015 ^[38]
28	<i>Drepanocerus setosus</i> Wiedemann	Scarabaeidae	Coleoptera	Punjab	Ali <i>et al.</i> , 2015 ^[38]
29	<i>Catharsius (Catharsius) sagax</i>	Aphodiinae	Coleoptera	Punjab	Noureen <i>et al.</i> , 2015 ^[1]
30	<i>Tiniocellus (Tiniocellus) spinipes</i>	Aphodiinae	Coleoptera	Punjab	Noureen <i>et al.</i> , 2015 ^[1]
31	<i>Oniticellus (Oniticellus) cinctus</i>	Aphodiinae	Coleoptera	Punjab	Noureen <i>et al.</i> , 2015 ^[1]
32	<i>Aphodius (Paraphodius) crenatus</i>	Aphodiinae	Coleoptera	Punjab	Noureen <i>et al.</i> , 2015 ^[39]
33	<i>Charmon ovchinnikovii</i>	Braconidae	Hymenoptera	Chitral	Sabahatullah <i>et al.</i> , 2015 ^[40]
34	<i>Charmon extensor</i>	Braconidae	Hymenoptera	Chitral	Sabahatullah <i>et al.</i> , 2015 ^[40]
35	<i>Dacus sphaeroidalis</i>	Tephritidae	Diptera	Pakistan	Sarwar & Riaz 2014 ^[41]
36	<i>Sathrophyllia saeedi</i>	Tettigonioidae	Orthoptera	Sindh, KPK	Sultana <i>et al.</i> , 2014 ^[42]
37	<i>Sathrophyllia irshadi</i>	Tettigonioidae	Orthoptera	Sindh, KPK	Sultana <i>et al.</i> , 2014 ^[42]
38	<i>Scaeva selenitica</i>	Syrphidae	Diptera	Gilgit-Baltistan	Rafi <i>et al.</i> , 2014 ^[43]
39	<i>Xylocopa acutipennis</i>	Apidae	Hymenoptera	Gilgit-Baltistan	Rafi <i>et al.</i> , 2014 ^[43]
40	<i>Eristalis tenax</i> Linnaeus	Syrphidae	Diptera	Balochistan	Truk <i>et al.</i> , 2014 ^[44]
41	<i>Eristalis arbustorum</i> Linnaeus	Syrphidae	Diptera	Balochistan	Truk <i>et al.</i> , 2014 ^[44]
42	<i>Anthrenus (Nathrenus) narani</i>	Dermestidae	Coleoptera	Pakistan	Hava & Ahmed 2014 ^[45]
43	<i>Hockeria nikolskayae</i>	Chalcididae	Hymenoptera	KPK	Iqbal <i>et al.</i> , 2013 ^[46]
44	<i>Hockeria anupama</i>	Chalcididae	Hymenoptera	KPK	Iqbal <i>et al.</i> , 2013 ^[46]
45	<i>Hockeria manii</i>	Chalcididae	Hymenoptera	KPK	Iqbal <i>et al.</i> , 2013 ^[46]
46	<i>Bonomiella columbae</i>	Columbidae	Phthiraptera	Karachi region	Naz <i>et al.</i> , 2012 ^[47]
47	<i>Campanulotes compar</i>	Columbidae	Phthiraptera	Karachi region	Naz <i>et al.</i> , 2012 ^[47]
48	<i>Columbicola tschulyschman</i>	Columbidae	Phthiraptera	Karachi region	Naz <i>et al.</i> , 2012 ^[47]
49	<i>Hohorstiella lata</i>	Columbidae	Phthiraptera	Karachi region	Naz <i>et al.</i> , 2012 ^[47]
50	<i>Hohorstiella streptopeliae</i>	Columbidae	Phthiraptera	Karachi region	Naz <i>et al.</i> , 2012 ^[47]
51	<i>Turturicola salimalii</i>	Columbidae	Phthiraptera	Karachi region	Naz <i>et al.</i> , 2012 ^[47]
52	<i>Vespula nursei</i>	Vespidae	Hymenoptera	KPK	Mahmood <i>et al.</i> , 2012 ^[48]

53	<i>Polistes (Polistella) stigma tamulus</i>	Vespidae	Hymenoptera	KPK	Mahmood <i>et al.</i> , 2012 ^[48]
54	<i>Polistes (Gyrostoma) olivaceus</i>	Vespidae	Hymenoptera	Pakistan	Mahmood <i>et al.</i> , 2012 ^[48]
55	<i>Ropalidia brevita</i>	Vespidae	Hymenoptera	KPK	Mahmood <i>et al.</i> , 2012 ^[48]
56	<i>Ropalidia cyathiformis</i>	Vespidae	Hymenoptera	KPK	Mahmood <i>et al.</i> , 2012 ^[48]
57	<i>Ancistrocerus gazella</i>	Vespidae	Hymenoptera	Pakistan	Mahmood <i>et al.</i> , 2012 ^[48]
58	<i>Anterhynchium flavomarginatum flavomarginatum</i>	Vespidae	Hymenoptera	Pakistan	Mahmood <i>et al.</i> , 2012 ^[48]
59	<i>Mantispa styriaca</i>	Mantispidae	Neuroptera	Pakistan	Mirmoayed <i>et al.</i> , 2012 ^[49]
60	<i>Mantispa scabricollis</i>	Mantispidae	Neuroptera	Pakistan	Mirmoayed <i>et al.</i> , 2012 ^[49]
61	<i>Nampista auriventris</i>	Mantispidae	Neuroptera	Pakistan	Mirmoayed <i>et al.</i> , 2012 ^[49]
62	<i>Gnopharmia colchidaria objectaria</i>	Geometridae	Lepidoptera	Pakistan	Rajaei SH <i>et al.</i> , 2012 ^[50]
63	<i>Gnopharmia irakensis</i>	Geometridae	Lepidoptera	Pakistan	Rajaei SH <i>et al.</i> , 2012 ^[50]
64	<i>Libellago lineata (Burmeister)</i>	Platycnemididae	Odonata	Pakistan	Zia <i>et al.</i> , 2011 ^[51]
65	<i>Elatoneura atkinsoni (Selys)</i>	Platycnemididae	Odonata	Pakistan	Zia <i>et al.</i> , 2011 ^[51]
66	<i>Elatoneura souteri (Fraser)</i>	Platycnemididae	Odonata	Pakistan	Zia <i>et al.</i> , 2011 ^[51]
67	<i>Junonia (Precis) atlites</i>	Nymphalidae	Lepidoptera	Pakistan	Naz <i>et al.</i> , 2010 ^[52]
68	<i>Sergentomyia (Sergentomyia) punjabiensis</i>	Psychodidae	Diptera	Sindh Province	Khel 2009 ^[53]
69	<i>Lestes patricia</i>	Lestidae	Odonata	Pakistan	Rafi <i>et al.</i> , 2009 ^[54]
70	<i>Orthetrum glaucum Brauer</i>	Libellulidae	Odonata	Northern areas	Zia <i>et al.</i> , 2009 ^[55]
71	<i>Orthetrum taeniolatum Schneider</i>	Libellulidae	Odonata	Northern areas	Zia <i>et al.</i> , 2009 ^[55]
72	<i>Sympetrum commixtum Selys</i>	Libellulidae	Odonata	Northern areas	Zia <i>et al.</i> , 2009 ^[55]
73	<i>Sympetrum fonscolombi Selys</i>	Libellulidae	Odonata	Northern areas	Zia <i>et al.</i> , 2009 ^[55]
74	<i>Sympetrum meridionale Selys</i>	Libellulidae	Odonata	Northern areas	Zia <i>et al.</i> , 2009 ^[55]
75	<i>Libellago greeni Laidlaw</i>	Chlorocyphidae	Odonata	Northern areas	Zia <i>et al.</i> , 2009 ^[55]
76	<i>Mortonagrion gautama Fraser</i>	Coenagrionidae	Odonata	Northern areas	Zia <i>et al.</i> , 2009 ^[55]
77	<i>Vespa flaviceps</i>	Vespidae	Hymenoptera	Pakistan	Vorak 2007 ^[56]
78	<i>Polistes (Polistes) biglumis</i>	Vespidae	Hymenoptera	Pakistan	Vorak 2007 ^[56]
79	<i>Polistes (Polistes) gallicus</i>	Vespidae	Hymenoptera	Pakistan	Vorak 2007 ^[56]
80	<i>Polistes (Polistella) quadricingulatus</i>	Vespidae	Hymenoptera	Pakistan	Vorak 2007 ^[56]
81	<i>Adalia bipunctata (Linnaeus)</i>	Coccinellidae	Coleoptera	Chitral	Khan <i>et al.</i> , 2006 ^[57]
82	<i>Macroilleis (Halysia) hauseri</i>	Coccinellidae	Coleoptera	Chitral	Khan <i>et al.</i> , 2006 ^[57]
83	<i>Chilocorus circumdatus (Gyllenhal)</i>	Coccinellidae	Coleoptera	Chitral	Khan <i>et al.</i> , 2006 ^[57]
84	<i>Callogryllus ovilongus</i>	Gryllidae	Orthoptera	Pakistan	Saeed <i>et al.</i> , 2000 ^[58]
85	<i>Plebiogryllus retiregularis</i>	Gryllidae	Orthoptera	Pakistan	Saeed <i>et al.</i> , 2000 ^[58]

5. Problems to overcome

5.1 Funding: Financial support is the most important problem in taxonomic research ^[59]. Sufficient funding's should be given to institutes and universities to promote the development of taxonomic specialist ^[5]. Scholarships should be given to those students who choose field of taxonomy for their doctoral research program. In addition, enough funds should be offered for taxonomists to visit international centers of taxonomic research.

5.2 Syllabus: Taxonomy subject should be compulsory at graduate and post-graduate levels ^[25]. At present, there is no adequate importance for the field of taxonomy in Pakistan.

5.3 Training: Just like abroad, short training courses for identification of various families of insects should be offered to entomologists as well as students. These courses will help to start taxonomic research ^[60].

5.4 Libraries: No research paper becomes outdated in taxonomy ^[25]. Unfortunately, most taxonomic paper published by foreign scientist is not easily available in Pakistan. Study of insect's taxonomy requires all relevant literature ^[62]. So, the Government should establish such places where researcher can easily find relevant information.

5.5 Publication of research papers: There are few journals in Pakistan for specific to taxonomy. Unfortunately, these journals need more duration to publish papers due to workload. There is a need to increase the number of journals in Pakistan, to publish taxonomic work, with less publish and access charges.

5.6 Identification service: There are very rare specialists all over the country who can do identification of insects. Adequate financial support should be provided for establishment of identification centers in different locations of country.

6. Conclusion

Pakistan is an agricultural country and blessed with a lot of fauna but lack of interest in proper education, research and identification of species resulted to negligence in basic field of biology; taxonomy. Keeping in view the significance of taxonomy, there is urgent need to organize research facilities, hire basic courses at undergraduate as well post graduate level and establishment of regular organizations for preservation of this valuable fauna.

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