

Hawaii's Systematics Resources in Entomology¹

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"Systematics collections are complex information acquisition, storage and retrieval systems comprising specimen samples of organisms and associated information about them" (Irwin et al. 1973). Recent awareness of the importance and quality of systematics collections as a national resource has led to a series of studies and reports on the present status of systematics collections and their future needs. The predominant themes of these reports are that systematics resources must be improved and used more effectively and efficiently. The report, "*America's Systematics Collection: A National Plan*" (Irwin et al. 1973), briefly summarizes previous studies and presents a National Plan "designed to make systematics collections and their associated institutions a more effective national resource system."

This report to the Association of Systematics Collections contains:

- (1) statements of the primary goals of the systematics collections community;
- (2) description of the specific goals of the systematics collections community with respect to improving the condition of the collections and the services they provide;
- (3) discussion of systematics in science and society today;
- (4) discussion of the problems affecting the systematics collections community;
- (5) specific recommendations that will move to resolve the problems and enable the systematics collections community to realize its goals; and
- (6) statement of priorities and estimated costs of implementing them.

One of the recommendations of this report was the establishment of advisory committees representing those elements of the systematics community concerned with systematics collections. The Advisory Committee of the Entomological Society of America was one of the several committees established. The Advisory Committee for Systematic Resources in Entomology is the first committee to present a detailed organizational plan for systematics resources (Hurd et al. 1974). The unanimous passage of this proposed plan by the membership of the Entomological Society of America at the annual meeting in Minneapolis, December 5, 1974 is certainly a commendation to the Committee for developing the plan, and to the Society for quick action on the plan. The Society also approved the formation of a standing committee on Systematics Resources.

The recommended establishment of a National Institute of Systematic Entomology (NISE), as outlined in the above plan, was approved and should greatly advance the organized growth and development of our systematics resources. The organization and functions of the NISE are briefly as follows:

¹Presidential address presented at the December 1974 meeting of the Hawaiian Entomological Society.

A. *Council and Secretariat.*

1. Council to be composed of 9 members to function as a Board of Governors to develop broad policies of, recommend action by, and exercise veto authority over NISE. Council members are to be selected by the national Research Council of the National Academy of Sciences.

2. Secretariat to be composed of a Chairman and supporting staff which will be the administrative body for NISE. The Chairman will be selected by the Council of NISE. The functions of the Secretariat include development or general administrative policies pertaining to Resource Centers, Service Centers and specialized collaborative institutions and individuals. Specific functions are outlined in the National Plan.

B. *Resource Centers* will be those institutions that maintain large (usually over one million specimens) and diverse collections on a permanent basis with a commitment to make these collections available for use by the systematics community. Common functions would include collection maintenance, basic research in systematics and evolutionary biology of arthropods, and on-the-job training of personnel in curatorial and related techniques and other services of a specific nature.

C. *Service Centers.* The Service Centers will be mission-oriented and are designed to provide essential services in support of the many activities that require systematics expertise.

1. Three categories are recommended: One National Service Center, several State or Regional Service Centers and Local Service Centers. The functions of each are outlined in the National Plan.

D. *Specialized Collaborating Institutions and Individuals.* These specialized institutions or individuals will become formally affiliated with NISE as Specialized Collaborators through contract arrangements with the Secretariat or with the National Regional Service Centers.

The overall plan of the NISE is excellent but its success will depend upon adequate funding and the activities and dedication of the NISE Council and Secretariat. The members of the Hawaiian Entomological Society will be affected by this plan as it will affect the systematics resources in Hawaii.

HAWAII'S SYSTEMATICS RESOURCES IN ENTOMOLOGY

Hawaii's geographical position, its ties to the Pacific Basin and the Orient, and its unique island fauna have all contributed to making our entomological resources, including collections and associated libraries, one of the most significant in the nation. Our vast entomological resources reflect not only extensive faunal surveys and taxonomic research, but also highly significant agricultural, biological control, ecological, genetic, and medical entomological studies. Numerous members of the Hawaiian Entomological Society have contributed in the past, and continue to contribute to and develop this vast resource.

The major systematics collections in Hawaii are at the Bishop Museum, Hawaii State Department of Agriculture, and the University of Hawaii. Smaller but highly significant collections are located throughout the state. These include the following:

(1) Hawaii State Department of Health, Vector Control Branch, has a collection of medically important arthropods and stored products pests curated by James Ikeda;

(2) various section collections of the Hawaii State Department of Agriculture Plant Quarantine Service, which include synoptic collections of insect pests;

(3) Animal and Plant Health Inspection Service, U.S. Department of Agriculture;

(4) Entomology Department, Navy Preventive Medicine Unit No. 6, Pearl Harbor has a collection of medically important arthropods including a significant collection from Viet Nam;

(5) Mr. Bernard B. Sugarman of the Entomology Program, U.S. Army Hawaii at Fort Shafter, has a large collection of arthropods from Kwajalein and Hawaii.

Private collections include those of Dr. C.R. Joyce, Mr. Robin Rice, Mr. K. Sakimura, Mr. F. Bianchi and others. There are undoubtedly other collections in the state of which I am not aware. All collections, no matter how small, are significant if properly labeled and curated. They are especially important if associated biological data are available.

The three largest collections in Hawaii mentioned previously are all important in that there is a different emphasis on each. The Bishop Museum collection is the largest, with approximately 11 million specimens and 10,386 primary types (Table 1). The pinned collections are housed in 9,322 California Academy drawers (Table 2). The major orders represented are Coleoptera, Diptera, Hymenoptera, Lepidoptera and Arachnida (Table 3). The major geographic emphasis in order of importance are Oriental Region (including Oceania), Australasian Region (including New Guinea), Hawaiian Islands, Palearctic Region and Neotropical Region (Table 4). Other unique or outstanding collections are listed in Table 5. The 9 systematists on the Bishop Museum staff and their specialties are listed in Table 6.

The Department of Entomology collection at the University of Hawaii is the second largest collection with an estimated 165,000 specimens (Table 1). The pinned collections are housed in 520 Cornell drawers (Table 2). The total figures in Table 1 do not include the extensive teaching collection which has not been estimated. The major orders represented are Diptera, Hymenoptera and Homoptera (Table 3). The major geographical emphasis in order of importance are the Hawaiian Islands, Australian Region, Oriental Region (including Oceania), Palearctic Region and Neotropical Region (Table 4). This collection includes the most complete collection of Hawaiian Diptera; the largest collection of Southeast Asian Tephritidae and worldwide collections of Bibionidae and Pipunculidae. All Diptera collections were amassed and sustained in a large degree by Dr. D.E. Hardy. These collections also include a very large collection of Coccoidea (mealybugs and scale insects) composed of approximately 8,000 slide-mounted specimens built up by Dr. J.W. Beardsley. Two staff members are engaged in systematic studies. Dr. Hardy works on all the Hawaiian Diptera and specializes in Bibionidae, Drosophilidae, Pipunculidae, and Tephritidae. Dr. Beardsley works on Hymenoptera and specializes in Coccoidea.

The third largest collection is in the Entomology Department of the Hawaii State Department of Agriculture with approximately 130,000 specimens (Table 1) housed primarily in 480 Cornell type drawers (Table 2). The major orders represented are Coleoptera, Hymenoptera, Lepidoptera, Diptera, and Homoptera (Table 3). The major geographic emphasis in order of importance are Hawaiian Islands, Australian Region, Mexico, Oriental Region, and Neotropical Region. This collection has been enlarged through the efforts of the Department of Agriculture staff, their exploratory entomologists and by the acquisition of the Hawaiian Sugar Planters' Association collection of Hawaiian insects in 1964². Mr. George Funasaki is curator of this collection.

The three major collections differ significantly in composition and geographic emphasis and thus complement each other. Both the University of Hawaii and State Department of Agriculture are strongest in their collections of Hawaiian insects. These collections combined undoubtedly contain the most complete collection of Hawaiian insects in the world. The State Department of Agriculture also has a significant collection of insects from Mexico which the other two collections lack. These Mexican collections were the result of work by exploratory entomologists gathering material for possible biological control application. The Bishop Museum has the largest collection of insects from the Oriental Region including Oceania and New Guinea.

The second aspect of Systematics Resources in Entomology includes associated libraries and reprint files. Considerable effort has gone into the compilation of the entomological holdings at the Bishop Museum, Hawaiian Sugar Planters' Association, and University of Hawaii by the Library Committee of the Hawaiian Entomological Society. Hopefully, this detailed information will be made available to the membership. The bulk of the entomological library of the Hawaiian Entomological Society, until recently housed at the Hawaiian Sugar Planters' Association, is now deposited in the University of Hawaii Library. This undoubtedly makes the University library the most significant entomological library in the Pacific Basin. Next in importance is the Bishop Museum Entomology Library with approximately 7,000 volumes. The reprint collection at the Museum is probably the largest in the state with approximately 64,000 reprints. The Hawaii State Department of Agriculture Entomology Library has approximately 1,350 volumes and 300 reprints.

Additional important resources at various institutions are card files which often contain very important data which are unpublished. The Bishop Museum's card files and their significance are listed in Table 7. The Hawaii Department of Agriculture has a file of approximately 1,000 cards on parasitic Hymenoptera of the Hawaiian Islands. Information on the card files at the University is not available.

In conclusion, I wish to thank the many entomologists who have contributed to this report, especially the staff at the Bishop Museum, Dr. Beardsley and Dr. Hardy and the University and Mr. Funasaki at the State Department of Agriculture.

²HSPA also donated 153,000 insect specimens, including approximately 2,110 primary types, to the Bishop Museum. This comprised most of HSPA's non-Hawaiian insect collection.

TABLE 1. *Collection Holdings at Major Institutions in Hawaii*

	<i>Bishop Museum</i>	<i>Hawaii State Dept. of Agriculture</i>	<i>University of Hawaii Dept. of Entomology</i>
Pinned specimens	6,491,000	119,829	150,000 ¹
Specimens in fluid	2,343,000	2,000	2,000 ¹
Specimens on slides	250,000	6,525	12,000 ¹
Papered specimens	505,000	--	--
Specimens awaiting preparation	1,125,000	3,000	1,000
Total preserved specimens	10,714,800	131,354	165,000 ¹
Primary types	10,386	none	none
Species	127,000	5,200	10,000
New specimens received annually	205,000	10,000	5,000

¹Teaching collection is housed separately and is not included in these totals.

TABLE 2. *Number and Type of Units Used to House Specimens in Major Collections in Hawaii.*

	<i>Bishop Museum</i>	<i>Hawaii State Dept. of Agriculture</i>	<i>University of Hawaii Dept. of Entomology</i>
Number of Drawers	9,322	480	520
Schmitt Boxes	1,265	52	20
Other (Display, etc.)	35	10	10

TABLE 3. *Composition of Major Collections in Hawaii.*

	<i>Bishop Museum</i>	<i>Hawaii State Dept. of Agriculture</i>	<i>University of Hawaii Dept. of Entomology</i>
Arachnida	12%	--	2%
Coleoptera	21%	22%	8%
Diptera	20%	11%	53%
Hemiptera	4%	8%	3%
Homoptera	4%	11%	10%
Hymenoptera	13%	18%	15%
Lepidoptera	13%	18%	7%
Orthoptera	2%	2%	1%
Others	11%	10%	1%

TABLE 4. *Ranking of Geographic Emphases of Major Collections in Hawaii.*

	<i>Hawaii State</i>		
	<i>Bishop Museum</i>	<i>Dept. of Agriculture</i>	<i>University of Hawaii Dept. of Entomology</i>
Hawaiian Islands	3	1	1
Australian (+ Papuan Area)	2	2	2
Mexico	--	3	--
Neotropical	5	5	5
Oriental (+ Oceania)	1	4	3
Palearctic	4	--	4

TABLE 5. *Unique or Outstanding Special Collections at the Bernice P. Bishop Museum.*

<i>Collection</i>	<i>Significance</i>
Hawaiian Archipelago	Paramount collections (approximately $\frac{1}{3}$ material in <i>Fauna Hawaiiensis</i> , Tanager Expedition, primary types for Diptera of Hawaii, etc.; approximately 80% of species reported from Hawaii).
Oceania	The leading collection (material from throughout Pacific; types and other material covered in Insects of Micronesia.).
Antarctic, Subantarctic, Arctic, New Guinea, Australia, Oriental Region, Eastern Palearctic Region	These areas are each strongly represented for a number of higher categories; polar and subpolar regions have been intensively surveyed, especially in the Southern Hemisphere, regular collecting has been carried out in New Guinea and the rest of Papuan Subregion since 1958; a number of expeditions, major collections contributed, and collaboration on regional projects have provided strong representation from other areas specified.
Coleoptera: Chrysomelidae, Cerambycidae, Curculionidae, Lycidae, Elateridae, Coccinellidae	Include collections of Koebele, Muir, Van Zwaluwenberg, Hicker, Zimmerman, Gressitt, Sedlacek, Rondon, and others.
Hymenoptera: higher families	
Hemiptera: Aradidae, Lygaeidae, Miridae	
Diptera: Culicidae of New Guinea	Largest collection.
Psychodidae of Pacific Area	Largest collection.
Sciaridae	Largest collection.
Pupipara	One of largest (much of material under study by T.C. Maa, Bishop Museum staff, and temporarily housed in Taipei).
Orthopteroids: Phasmidea	
Ectoparasitic Orders: Siphonaptera, Mallophaga, Anoplura	
Acarina: Parasitic Mesostigmata	One of several major world collections.
Parasitic Acarina of Papuan Subregion	Largest collection.
Pacific Cryptostigmata	
Antarctic and Subantarctic mites	
Trombiculidae	About 25% of described species—over $\frac{1}{3}$ represented by paratypes and/or holotypes.
Recent IBP collections—Hawaii	All material of newly discovered rich carvernicolous fauna of lava tubes; survey material of foliar and soil arthropods, etc.
Ship and plane trapping	Major documented collection of aerial dispersal studies.

TABLE 6. *List of Systematists at the Bernice P. Bishop Museum and their Specialities.*

<i>Name</i>	<i>Research Speciality</i>	<i>Responsibility for Collections (taxa)</i>
Frank J. Radovsky	Systematics of Acarina; particularly parasitic Mesostigmata; medical entomology, soil zoology.	All entomological collections as Chairman
J. Linsley Gressitt	Systematics of Coleoptera (esp. Cerambycidae, Chrysomelidae; biogeography; airborne dispersal of arthropods; polar entomology; epizotic symbiosis of weevils; ecology of boring beetles.	Curating Coleoptera in part; advisory on curatorial procedures for all of Dept. of Entomology
Wallace A. Steffan	Diptera: Culicidae of Papuan Region; <i>Toxorhynchites</i> of the World; Sciariidae; medical entomology.	Diptera Section
G. Allan Samuelson	Coleoptera: Cerambycidae, Chrysomelidae, etc.	Coleoptera, orthopteroids, minor orders; curatorial procedures and data processing.
Tsing-Chao Mao	Diptera: Pupipara; Hemiptera: Cimicidae; parasitic Dermaptera; Homoptera; Hymenoptera.	Actively studied collections in parasitic groups listed (based in Taipei); overseas insect-mounting program.
Joaquin A. Tenorio	Diptera: Culicidae of Papuan Region; Diopsidae, Ephydriidae, Sphaeroceridae.	Diptera
JoAnn M. Tenorio	Acarina: parasitic and soil Mesostigmata; Diptera: Dolichopodidae, Celyphidae.	Acarina, other Arachnida and non-insect arthropods, ectoparasites.
Francis G. Howarth	Diptera: Ceratopogonidae, biospeleology, insects of Hawaii.	Hawaiian collection.
Wayne C. Gagne	Hemiptera, especially Miridae, community ecology, Hawaiian insects.	Hemiptera, Lepidoptera, Hymenoptera, Hawaiian collection.

TABLE 7. *Special Libraries and Reprint Collections Associated with Collections.*

	<i>Hawaii State</i>		<i>University of Hawaii Dept. of Entomology</i>
	<i>Bishop Museum</i>	<i>Dept. of Agriculture</i>	
Volumes in Library	7,000	1,350	*
Reprint Collections	64,100	300	**

*U.H. Ent. Dept. does not have a Departmental library. They rely upon holdings at U.H. Hamilton Library, which has the largest collection of entomological publications in Hawaii.

**Individual researchers have their own personal reprint collection and libraries.

LITERATURE CITED

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