sip newsletter

society for invertebrate pathology

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THE INSECT PATHOLOGY RESOURCE CENTER

Cornell University, Ithaca, NY

Although individual students had worked on various insect pathology problems previously, the topic was not formally initiated on the Ithaca, New York campus of Cornell University (CU) until 1964 when Dr. John P. Kramer joined the Department of Entomology. In 1978 the Boyce Thompson Institute (BTI), a nonprofit research organization initiated in 1923, moved from Yonkers, New York (near New York City) into a new four-story building on the CU Ithaca campus. BTI is subdivided into programs, one of which is Biological Control. Most members of this group work with insect pathogens, but there is an insect physiology subgroup. Also in 1978 Dr. Richard S. Soper of the US Department of Agriculture transferred from Maine to space in the BTI building where he assembled a group to work on Entomophthorales. This unit is called the USDA-SEA-AR Insect Pathology Research Unit.

Late in 1979 an informal consortium of the three groups was formed under the title "Insect Pathology Resource Center" (IPRC). The functions of the group are training, pathogen repository, consulting, and basic and applied research. Emphasis is on microbial control of pests, and the group is particularly interested in studies which bridge basic and applied research. The staff normally numbers approximately 15 at the professional level with a similar number of technical assistants. The current staff includes:

NAME	AFFILIATION	SPECIALTIES
Staff		
Thomas E. Anderson	BTI	Entomopathogen-pathogen interactions
Ray Carruthers	CU	Fungal epizootiology
Richard A. Daoust	BTI	Insect pathology, bacterial and fungal pathogens
Robert R. Granados	BTI	Insect virology, ultrastructure and cell culture
Patrick R. Hughes	BTI	Bioassay and mode of action of viruses
Richard A. Humber	USDA	Insect mycology, systematics
John P. Kramer	CU	Entomophthorans and microsporidians of dipterous insects
Donald W. Roberts (Coordinator: IPRC)	BTI	Insect pathology, insect mycoses, diseases of medically important arthropods, toxins
Anthony Shelton	CU	Field evaluation
Maurie Semel	CU	Field evaluation
Richard S. Soper	USDA	Insect mycoses, epizootiology
H. Alan Wood	BTI	Insect virology, host-virus interactions
Postdoctoral Fellows		
Jeff Lord	BTI	Microbial control of vectors
John P. Burand	BTI	Insect viruses
Brad Stiles	BTI	Insect viruses
Stephen Wraight	BTI	Insect mycology
Consultant		
Michael G. Ward	USDA/BTI	Microbial formulations
Graduate Students		
Chris Tarrant	CU/USDA	Diseases of blackflies
Susan Webb	CU/BTI	Virology
Sandra Galaini	CU/BTI	Fungal diseases
Zi-ding Feng	CU/BTI	Fungal diseases

Visiting scientists conducting studies at IPRC in the past 18 months include: Albrecht Gröner (W. Germany), Zeng-zhi Li, Bao-ling Cai, and Kaijiang Lin (People's Republic of China), Claudio L. Messias (Brazil), and Anthony Sweeney (Australia).

IPRC, with financial assistance from the Rockefeller Foundation, conducted a "Workshop on Insect Pest Management with Microbial Agents: Recent Advances, Deficiencies, and Innovations" in May, 1980. There were approximately 200 participants and 50 speakers and panelists representing 25 nations. A 70-page "Proceedings" including abstracts and recommendations is available gratis. (Contact Don Roberts, IPRC, Boyce Thompson Institute, Tower Road, Cornell University, Ithaca, NY 14853.)

We are looking forward to hosting the SIP meeting during August 7-11, 1983 and hope you enjoy what we think is an exceptionally pleasant physical and intellectual environment.

BACILLUS THURINGIENSIS VAR. ISRAELENSIS

I have persuaded Dr Pierre Guillet to contribute this note on the use of Bacillus thuringiensis on a large operational scale in an important disease eradication program. Operational use on this scale, only 6 years after the strain was first isolated from mosquitoes in Israel, must surely be an inspiration to us all.

H.D. Burges

BIOLOGICAL CONTROL OF ONCHOCERCIASIS IN WEST AFRICA

P. Guillet

Seven West-African countries (Benin, Ghana, Ivory Coast, Mali, Niger, Togo and Upper-Volta) have requested the assistance of four International Organizations (the World Bank, FAO, UNDP and WHO as the executing Agency) and a group of donor countries to plan, organize, implement and evaluate a campaign against onchocerciasis.

The strategy to be applied against this disease is imposed by the constraints related to the parasite, the vectors and the environment in which the disease is transmitted.

The parasite, Onchocerca volvulus is known to live, in the human body, more than 10 years and there are presently no drugs available for mass treatments. Thus, the only possible way of combating this disease is to suppress - or reduce to a tolerable level - the transmission of the parasite by controlling the vectors.

In West Africa, all vectors are blackflies of the Simulium damnosum complex composed of six main species. The life-cycle of the larvae is very short (6 to 12 days, i.e. 25 to 30 generations per year). The breeding sites of pre-imaginal instars are found in the rapids along rivers of medium size (few m^3/sec.) to large (up to 1000 m^3/sec.) or more.

The adults of S. damnosum are known to disperse and migrate over long distances (up to 400 km). Thus, to be efficient, a control campaign ought to be carried out simultaneously over large areas so as to minimize the re-invasion of treated areas by fertile and infected immigrating flies.

Although the extent of female dispersion and migration makes it difficult to contemplate the use of an adulticide, the relative concentration of the larval breeding sites of S. damnosum s.l. permits a campaign based on the destruction of the larvae.

The Onchocerciasis Control Programme (OCP) is presently implemented by larviciding on a surface of approximately 750,000 km^2, including parts of seven countries. Inside this area, the breeding sites are located on approximately 14,000 km of rivers. They have to be monitored and, if necessary, treated weekly. This operation is planned for 15 years. The treatments have to be virtually 100% efficient, as the annual biting rate (ABR) has to be reduced to 1000 bites per man/year, in order to ensure that the disease is no longer a public health and socio-economic problem.

As most of the breeding sites are inaccessible, especially during the rainy season, treatments are carried out by aerial application of larvicides by fixed-wing aircraft and helicopters. The formulation, used undiluted, must be totally auto-dispersible and very efficient at low volume due to the limited load carried by the aircraft. It also has to carry the larvicide down-stream sufficiently to minimize the number of applications.

It should not be toxic for man and its effect on the environment must be as low as possible.

Abate(R), a 20% emulsifiable concentrate of temephos, an organophosphate (OP), fulfills these requirements. During the dry season, this formulation is utilized at a concentration of 0.1 mg/l for 10 min and each breeding site must be treated individually (poor carry relates to low discharge).

During the rainy season, the efficient dose is 0.05 mg/l/10 min, (the carry being increased up to 30-50 km). The re-loading of aircraft necessitates the storage of drums of insecticide and fuel in numerous field caches. In these caches, insecticide can stay in the sun and in the rain for long periods, sometimes more than a year. This requires an excellent storage stability of the products.

The annual consumption of Abate(R) for the total area of the OCP varies from 160,000 to 180,000 litres.

Unfortunately, two species of the S. damnosum complex (S. soubrense and S. sanctipauli) have rapidly developed a resistance to temephos. Chlorphoxim, another OP, has been used as an alternative until these two species became resistant to this new compound. Meanwhile, a cross-resistance to most of the OPs usable in vector control has been observed. The research for insecticides belonging to other classes (i.e. different from OPs) has been considerably intensified, but presently no new chemical has reached the operational level.

The resistance phenomenon which developed in the forest area has only a moderate effect on the reduction of disease transmission achieved so far, because the resistant species transmit only a mild form of onchocerciasis, i.e. the forest form. However, if such resistance extended to savannah species transmitting severe onchocerciasis, the risk of jeopardising 10 years of excellent results would be great.

In this respect, research on development and utilization of biological control agents represents the only alternative for the control of onchocerciasis through the destruction of its vectors. Bacillus thuringiensis H-14, due to its remarkable properties (efficiency, selectivity, stability) allowed a microbial insecticide to be utilized straightforwardly as an operational larvicide against S. damnosum.

To be usable against this species living in fast-flowing water, this compound, as any other compound including chemicals, must be properly formulated so as to allow all Simulium larvae to ingest a lethal dose. Research carried out in West Africa has shown that the best type of formulation is an aqueous suspension of free spores and crystals. The sedimentation of this formulation is limited and its efficacy is not linked to the time of contact with the larvae or with water turbidity.

Between different formulations, there is no systematic relation between the respective biological potencies, as expressed in Aedes aegypti International Units, and their efficacy against Simulium larvae. In contrast, for a given formulation, an increase of the potency against Aedes generally corresponds to an increase of efficacy against blackfly larvae.

A water dispersible concentrate - Teknar(R) developed by Sandoz - is now used operationally against OP-resistant Simulium populations at a uniform dosage (all seasons) of 1.6 mg/l/10 min. As for any other larvicides, its carry depends on the discharge of the rivers. Poor at low discharge, it can reach up to 20 km for high discharge (2.7×10^7 l/min). In practice, it is limited to 8-10 km.

To disperse spontaneously in the rivers, Teknar must be, prior to application, diluted with 20% water, which increases the quantities to carry and apply. Pure, or diluted, its stablity is outstanding as it can be stored more than 16 months in the sun without losing its efficiency.

Although Teknar has rapidly reached an operational status, it nevertheless shows certain limitations. To treat the whole area of the OCP where resistance has been declared, would need the equivalent of 80,000 l of Abate, i.e. 160,000 l of Teknar. Presently, in order to protect during 6-8 months (dry season) 2,500 km of rivers where resistance occurs, the programme has been obliged to double the budget devoted to insecticide.

For logistical reasons, mainly capacity of aircraft, it is still not possible to treat routinely rivers with discharges above 20 m^3/sec. Thus, the protection of the present zones of resistance is possible only through an alternation of Teknar (dry season) and chlorphoxim (rainy season), the OP against which larvae do not develop a stable resistance. For these reasons, it is vital to improve the formulation now in use. The present objective is to develop a self-dispersible formulation, 4 times more efficient than the present one. This objective is technically obtainable and industry is working actively in this direction. Firstly, the endotoxin concentration may be increased through cultivation on a rich medium and maximal final concentration. Secondly, formulation agents are used to optimise the toxin efficiency. Research should also be intensified to isolate and test new strains and to improve their fermentation concentration.

Thus research should be practical and directly applicable to the field problem. In addition, a better knowledge of the feeding behaviour - especially the way blackfly larvae catch small particles (0.5 to 1 μ) - could probably give a better understanding of certain physico-chemical properties which could guide industry in the design of better formulations.

Its utilization in a prestigious operation like the OCP, only 6 years after its discovery, is a remarkable achievement. Even if limited to the dry season, its use decreases the selection pressure by chemicals as well as, in the case of chlorphoxim, the adverse effect on the environment in a very sensitive ecological situation.

Integrated control of onchocerciasis vectors cannot be achieved through the simultaneous use of different control agents, but rather by an alternation of compounds showing drastically different modes of action.

For logistic reasons, the simultaneous utilization of more than two compounds is difficult to envisage. The alternating use of properly formulated B.t. H-14 during 8 months - dry season - and of a chemical during 4 months - rainy season - represents an optimal solution. The introduction of this in the whole OCP area is highly desirable. Although B.t. H-14 has its limitations one has to recognize that it is a remarkable solution to resistance against a chemical insecticide. But this is not its only merit as, even if not unanimously considered a traditional biological agent but, rather, as an insecticide of microbial origin, it has reinforced the credibility of biological control in the vector sphere and has shown the absolute necessity of increasing research in this field.

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INSECT PATHOLOGY IN THE PHILIPPINES

Formal instruction and organized research in insect pathology and its applied aspect, microbial control, have been going on in the Philippines since the early 1960's specifically at the University of the Philippines at Los Baños (UPLB) through the Department of Entomology.

Instruction in insect pathology at U.P. Los Baños, Department of Entomology is partly covered in an undergraduate course in biological control and in a graduate course entirely on insect pathology. With U.P. Los Baños being the center for graduate studies and research in agriculture for the Southeast Asian Region, both courses have attracted several students from throughout Southeast Asia. For the last three years we have had an average of 25 students in a class for the graduate course in insect pathology. A graduate program (master's and doctoral) in insect pathology is also offered and has already graduated a number of students.

Research in insect pathology is being conducted primarily on insects of economic importance to agriculture, forestry, and health. The main institution involved in research is the University of the Philippines at Los Baños through its various units namely: the Department of Entomology, National Institutes of Biotechnology and Applied Microbiology (BIOTECH), and the National Crop Protection Center (NCPC). With research funds from BIOTECH and NCPC of the University, and the National Research Council of the Philippines, a number of promising bacterial, viral and fungal insect pathogens are being developed for practical use on some major agricultural and medical insect pests.

With financial support from the World Health Organization (WHO) through the Department of Entomology a number of mosquito pathogens have also been discovered with great potential in the microbial control of mosquitoes. Among the pathogens discovered is an isolate of *Bacillus thuringiensis* of the variety *morrisoni* taken from a canal water sample in Central Philippines and found to be highly toxic to several species of mosquitoes including *Aedes aegypti*, *Culex* spp. and *Anopheles* spp. This was the first time such a variety was discovered from the tropics that is serologically different from *B.t.* subsp. *israelensis*. The bacterial isolate designated as PG-14 is now patented for use in the Philippines. The cooperation of our Japanese colleagues from the Institute of Biological Control at Kyushu University, Fukuoka, Japan in the development of the particular isolate is acknowledged. Dr. Leodegario E. Padua who is now connected with BIOTECH in the Philippines discovered and worked on the characteristics of this isolate for his doctoral dissertation at Kyushu University under the supervision of Prof. Keio Aizawa.

Other mosquito pathogens which we have been working on are two species of *Coelomomyces*. One, *Coelomomyces indicus*, is found to be prevalent on species of Anopheline in ricefields with *Microcyclops varicans* as alternate host. The other species attacking *Aedes aegypti* is *Coelomomyces stegomyiae* with alternate host identified as *Phyllognathopus viguieri*. Dr. Howard Whisler of the University of Washington at Seattle, U.S.A. has been cooperating with us on the studies of these two species and has visited us twice for long periods each time. Dr. Brian Federici of the University of California and Dr. Harold Chapman of the U.S. Department of Agriculture have also been our WHO consultants.

Outside UPLB, research in insect pathology is going on at the following places: the International Rice Research Institute (IRRI) also in Los Baños; Bureau of Plant Industry (BPI) at Tiaong, Quezon; the Philippine Coconut Authority (PCA) in Davao and Albay; and the Forest Research Institute (FORI) at Los Baños. At IRRI Mrs. Remedios Aguda in cooperation with Insect Pathologists of the Boyce Thompson Institute for Plant Research, Ithaca, New York, specifically Dr. Don Roberts and Dr. Richard Soper, has been working on the use of *Metarhizium* and *Entomophthora* for the control of the brown planthopper *Nilaparvata lugens* on rice.

At the Bureau of Plant Industry Mrs. Venus Fandialan has been doing studies on the use of *Metarhizium* and other pathogens for the control of coconut pests. With the assistance of German insect pathologists Dr. Bernhard Zelazny and Dr. Alois M. Huger, research is now in full swing at the Philippine Coconut Authority with Mr. Reynaldo Abad on the use of baculovirus against the rhinoceros beetle.

Scientists headed by Dr. Sebastian Quiniones at the Forest Research Institute with headquarters in Los Baños have found one strain of *Bacillus thuringiensis* to be effective in controlling the pine shoot moth, a serious pest of pine trees in the Philippines.

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MINUTES OF THE 1983 ANNUAL MEETING OF THE TECHNICAL COMMITTEE OF REGIONAL PROJECT S-135

The members of Regional Project S-135, "Development of Entomopathogens for Use in Pest Management Systems," met February 13-14, 1983 at the Imperial Palace, Las Vegas, Nevada. In addition, on February 15-17, the membership participated in an interdisciplinary national conference with ten other Regional Projects dealing with various aspects of biological control.

Clay McCoy, Chairman, welcomed all the members and introduced Dr. G. Allen, CSRS, who announced the agenda for the meetings and gave some comments on the news from Washington, D.C. Then the Chairman introduced Dr. L. O. Warren, the Project Administrative Advisor. Dr. Warren commented on Special Biological Control funds available for 1983 and introduced his successor, Dr. Dayton Steelman.

Dr. Warren reported that the US/Korea Research Exchange has agreed on areas of mutual interest and recommended a protocol for exchange of scientists. He gave a brief report on work in reforestation in South Korea.

Dr. McCoy reported that in 1982, S-135 received $58,200 in special funds for 1 year for research on Nomuraea rileyi. AR, SC, GA, AL, and FL in cooperation with the USDA laboratory at Columbia, MO, were involved. Dr. Warren reported that the Southern Region recommended the same amount for 1983.

Dr. W. Yendol reported on efforts to form a Subsection in Section C of the ESA dealing with "Insect Pathology and Microbial Control." The Subsection had been approved by Section C at the San Diego meeting, but was rejected by the 1982 summer meeting of the Governing Board. At the Toronto meeting, Section C again voted to submit the Subsection proposal to the Governing Board, and Dr. R. Granados suggested that a petition be sent to the Governing Board at the next summer meeting. Dr. L. Falcon moved and Dr. J. Harper seconded the motion that S-135 support the effort to form a Subsection in Section C of ESA on Insect Pathology and Microbial Control. The motion passed.

Dr. L. Falcon reported that the IR-4 program for registration of minor-use pesticides now includes biorationals and that it can be a source of money to assist in registration of biorational pesticides. Representatives from IR-4 held discussions on microbial registration on Tuesday and Wednesday at the Workshop. IR-4 is primarily interested in microbial agents that are nearly ready for commercial development.

Dr. C. Reichelderfer reported that the first draft of a manuscript on production of insect viruses was about three-fourths finished and should be completed in about a month. H. Kaya reported that the Nematode Subcommittee plans to publish a protocol for bioassay of nematodes. Dr. D. Boucias reported that the Fungus Subcommittee dealt primarily with Nomuraea and that they will publish a listing of geographical isolates of Nomuraea.

The 1984 meeting of S-135 will be held in Orlando, FL.

John J. Hamm
Secretary, S-135

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SAFETY WORKING GROUP

Two recent publications have been made available to our membership. These can be obtained from the Chairman on loan basis.

Ramakrishnan, N. et al., Indian Agricultural Research Institute. "Safety testing of nuclear polyhedrosis virus of *Diacrisia obliqua* (Walker)"

Samples, J.R. and Buettner, H. 1983. Amer. J. Ophthalmol. 95: 258-260. "Corneal ulcer caused by a biologic insecticide (*Bacillus thuringiensis*)".

Elizabeth W. Davidson
Chairman

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GENEROSITY OF MEMBERS APPRECIATED

The SIP Treasury is $60 richer through the voluntary contributions, over and above their 1983 dues payments, made by the following members:

K.Y. Arakawa
F. Kern
T.J. Kurtti
D.V. Lightner
A. Rosenfield
G.R. Stairs
G. St. Julian
A.C. Thompson
L.P.S. van der Geest

Our sincere thanks to these members.

A. Rosenfield
Treasurer SIP

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PROCEEDINGS OF THE COLLOQUIUM AT BRIGHTON, 1982

We still have a good supply of "Invertebrate Pathology and Microbial Control" Proceedings of the IIIrd International Colloquium on Invertebrate Pathology and XVth Annual Meeting of the Society for Invertebrate Pathology. For SIP members the price is £ (sterling) 10 or £20 for non members. If another currency is used, an extra amount equivalent to £2 should be added to cover the cost of conversion into sterling. Apply to H.D. Burges, Glasshouse Crops Research Institute, Littlehampton, West Sussex, BN16 3PU, UK.

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POSTERS AT ITHACA MEETING

Last minute posters will be accommodated at the Ithaca meeting. The poster session will be held Monday afternoon, August 8. Poster boards and pins will be provided. Please bring 30-50 copies of an abstract to distribute during the session, and plan to man your station at least one hour during the afternoon. Also, please advise Don Roberts or Leslie Allee (Boyce Thompson Institute) of your need for poster space prior to Monday so we can arrange for adequate numbers of poster boards.

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SIP ROAD RACE

It is not too late to register for the 5-km race to be held on August 10, 1983 at the SIP Meeting at Ithaca, N.Y. There will never be a better opportunity to finish among the first runners. Send in now to the undersigned the registration form that was enclosed with the February 1983 issue of the SIP Newsletter so that we can get the T-shirts for the race in time.

Jeff Lord
Boyce Thompson Institute
Tower Road
Cornell University
Ithaca, N.Y. 14853

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POSITIONS AVAILABLE

Postdoctoral Associate. Research and training in viral pathogenesis and insect cell culture. Experience in modern techniques in molecular biology preferred. Send curriculum vitae and names of three references to Dr. Robert R. Granados, Insect Pathology Resource Center, Boyce Thompson Institute, Tower Rd., Ithaca, New York 14853 U.S.A. Telephone 607/257-2030. Affirmative Action/Equal Opportunity Employer. Application deadline September 1, 1983.

Research Entomologist/Insect Geneticist. The U.S. Agricultural Research Service is recruiting for a Career Federal Service Research Entomologist or Research Geneticist (Insects) position at the Biological Control of Insects Research Laboratory, Columbia, Missouri. The position will be filled at the GS/M-11/12/13 level -- salary based on qualifications and experience. The incumbent will be Project Leader of a program responsible for research on the genetics of parasites, predators and pathogens of insect pests. Incumbent must have knowledge of insect genetics. For applications, contact J. Brooks, USDA-ARS-B64, 2000 W. Pioneer Parkway, Peoria, IL 61615. Tel: (309) 671-7813. Candidates must be citizens of the United States. An Equal Opportunity Employer.

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MEMBER CITED FOR OUTSTANDING WORK

Among 48 scientists recognized for meritorious achievements in the fourth annual Environmental Protection Agency competition, five scientists from the Environmental Research Laboratory on Sabine Island were cited.

Dr. John A. Couch (SIP member), Lee A. Courtney and Stephen S. Ross received a $2500 second-place prize for their study, "Laboratory Evaluation of Marine Fishes as Carcinogen Assay Subjects."

Henry F. Enos, director of the ERL on Sabine Island, said the scientists are recognized for accomplishments in environmental science and technology which are ultimately published in technical journals.

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MABRY STEINHAUS 'EXTRAORDINARIOUS'!

Mabry Steinhaus is the 1983 recipient of the Extraordinarious Title awarded by the Alumni Association of the University of California, Irvine. This title is awarded each year to the person who best exemplifies the spirit and purpose of UCI. Steinhaus received this tribute at the 13th annual Lauds and Laurels Banquet sponsored by the UCI Alumni Association on May 14.

Mabry Steinhaus' initial relationship with UCI was through marriage. Her husband, late Dr. Edward A. Steinhaus, a distinguished invertebrate pathologist and founder of SIP, was the founding dean of the School of Biological Sciences. The school's home, Steinhaus Hall, is named in his memory.

Since her husband's death in 1969, however, Mabry Steinhaus has formed her own bond with the university. A sampling of her involvement includes service as president of the UCI Foundation, Town and Gown, Interfaith Foundation and Faculty Associates. She has been a member of the Chancellor's Club and the University Club Board of Directors and has chaired the Foundation Marine Development Committee for seven years. She has made 42 financial gifts to the University of California and the UCI Foundation, including one to establish the Edward A. Steinhaus Memorial Fund for achievement in graduate teaching in the biological sciences.

Steinhaus herself holds a master's degree in bacteriology from Ohio State University. She organized her late husband's papers and edited his final book, "A Disease in Minor Chord." Her efforts earned her honorary membership in the international Society of Invertebrate Pathology.

But as her many supporters point out, it is not this list of accomplishments alone that earns Steinhaus the Extraordinarius title - it is that extra gift of herself.

Staff members of Interfaith wrote in her support, "No other person would be as generous with her time and energy and as devoted as she has been." Many of her supporters wrote with equal praise for her enthusiastic support of many other organizations. And that's an extraordinary amount of generosity.

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